

PC MAGAZINE



SPECIAL AWARDS ISSUE

Our Annual Technical Excellence Winners

- 12 V.90 Modems Go Head to Head
- Dvorak's Fearless 1999 Predictions
- Solutions: Secret Win 98 Easter Egg



FIRST LOOKS:

- Microsoft Internet Explorer 5 Beta
- Color Laser Printers
- Dragon Naturally-Speaking Mobile
- Epson USB Scanner
- Yahoo! and Excite Communities



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Easing into the Future

We've all heard the complaint: PCs are just too hard to use. And it's true. They can be difficult to set up, troublesome to upgrade, and tough to use. And that's when they're working right. They're even worse when something goes wrong. But don't get me wrong—I love PCs. They can do a variety of things, and I

believe they have made tasks like word processing far more productive, communications easier, and all sorts of fascinating educational and entertainment products possible.

The PC platform's detractors are quick to point out that PCs are much more complicated to use than toasters or televisions or automobiles. And they're right. In part, this is because computers are designed as general-purpose devices so that they can do all sorts of things. And in many ways, PCs are much more flexible than other devices, particularly other consumer electronics devices. Part of the price for this flexibility may well be more options and thus more complexity than in other consumer electronics devices.

Can computers be made easier to operate without losing their essential characteristics? I believe the answer is yes.

We're seeing a lot of new innovations in home computers—special keyboards, alternative user interfaces, and easier setup procedures. I like the new keyboards on the Compaq Presarios and IBM Aptivas, the new user interfaces on Packard Bell and Sony computers, and Acer's new Time-Machine feature, which automatically saves a working configuration of your computer to go back to if you install something that makes your system crash.

Of course, in an ideal world you wouldn't need such a crutch. And we wouldn't have things like software that crashes other software, interrupt conflicts, incomprehensible documentation, or interfaces that take months to learn.

But getting to that ideal won't be easy. It's like a cliché: Everyone complains that PCs are too hard to use, but no one does anything about it.

Well, here at *PC Magazine*, we've come to the conclusion that the time to do something about it is now. So starting with this issue, we're introducing a new rating system for consumer PCs—a rating sys-

tem that focuses on ease of use.

From now on we'll be giving each consumer PC we test an overall rating for ease of use, along with individual ratings for setup, learning and usability, and troubleshooting and support.

Like almost everything in *PC Magazine*, these ratings come from labs-based testing. But ease of use is not something you can benchmark-test just by running a simple program. Instead, we created a test script with nearly 200 questions that our reviewers go through meticulously to come up with consistent ratings.

Is this script perfect? Of course not. It's merely a first step toward coming up with a truly comprehensive method of evaluating ease of use on each PC we review.

We believe that making ease of use something that can be rated and scored in much the same way as performance will raise the bar for all computer vendors. And we believe that PC vendors, processor makers, and software companies can work together to make computers easier and better for all of us. But the most important part is still making them right for users like you and me.

To do that, we need your help. Download the script from our Web site (you can find it at www.pcmag.com/easeofuse). Try it on your PC and see how it works. After you've played with it, let us know what works, what doesn't work, and where else we should be looking.

Making computers simple or easy to use is far from a one-step process. It involves changes in just about every aspect of the computer. And it will require work from just about everyone in the PC process—the component makers, the software vendors, the PC companies, and you.

Most important, those of us who use computers need to demand more from our PCs and the people who make them. Join us. 

**Everyone
complains that
PCs are too
hard to use,
but no one
does anything
about it.**



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Editor-in-chief
Michael J. Miller
answers your computing
questions every Tuesday,
exclusively at *PC
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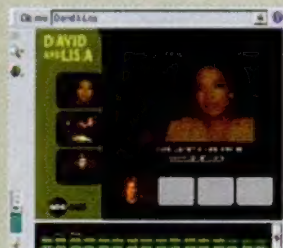
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Technical Excellence Awards

BY MICHAEL J. MILLER

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FEATURES

NETWORKING

Your Last Modem?

BY LES FREED

Sure, higher-speed connections—like cable and DSL—are siphoning off market share from modems, slowly but surely. Still, most people are in the market for at least one more modem, even if they hope it's their last. Here's our look at the first full crop of bona fide V.90 modems.....201

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AFTER HOURS

The Gift of Giving

BY JENNIFER TRIVERIO

So, you all pitched in and got Mom and Dad that new home PC. Great! Now pick out some games, gadgets, or

nice home reference software to give them. Or how about giving the kids a few games to take along the next time they sleep over at Grandma's? Here's our annual guide to more than 50 of the best PC gifts of the holiday season.....317

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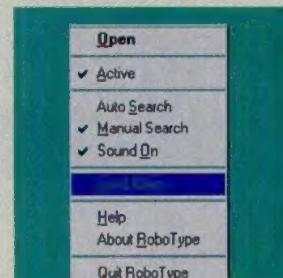
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ANY DIGITAL PHOTO CAN TRAVEL MILLIONS
OF MILES OVER THE INTERNET, BUT NOT
MANY CAN MAKE IT TEN FEET TO THE WALL.



Real photographs. That's the goal for digital camera users who want to print their photos. And that's where the HP PhotoSmart C20 digital camera with megapixel resolution enters the proverbial picture. It's chock full of resolution—try printing with 1152 x 872 pixels (then compare with photos from a VGA camera). It stores as many as 40 pictures in JPEG format on a compact, removable 4MB memory card (or up to 240 photos on an optional 48MB card). And because you can also use the 1.8 inch color LCD to review each shot, bad pictures can be instantly deleted to make room for other potential masterpieces. Then, once you have the shots you want, the C20 automatically downloads them into your PC where you can print out thumbnails of all your shots on an index sheet. (Or view your photos on a TV using the handy 16 foot video cable.) The **\$499*** C20 has all the features you'd expect to find—like a built-in flash, auto focus (plus macro mode for amazing close-ups), and a precision glass lens system, plus some you wouldn't expect, like Microsoft® Picture It!™ software and HP PhotoSmart photo finishing software. Many digital cameras give you features. How many give you real photos?

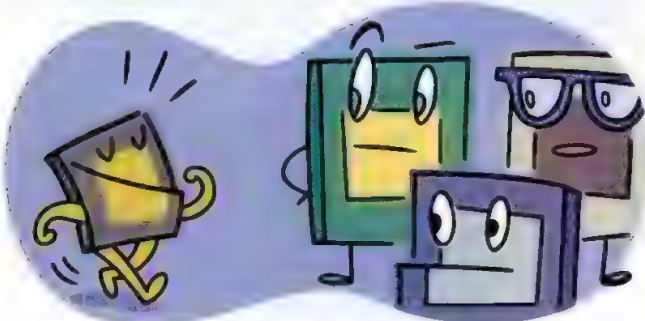


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AMD Aims High



Known for its low-cost alternatives to Intel microprocessors, AMD usually follows in Intel's wake in terms of CPU speed, features, and functionality. This gap is closing slightly with AMD's 350-MHz K6-2 and its upcoming 400-MHz K6-3. But one major difference remains: You still won't find AMD chips in workstations and servers, because the company's highest-end products just don't have the horsepower or the features to compete with Intel's wares.

With its K7 processor due in the first half of next year, AMD hopes to recast its image into one of a company that can provide leading-edge, high-powered microprocessors for workstation and server applications—chips that compete on an equal footing with Intel's finest. At the recent Microprocessor Forum, AMD previewed the K7, a 500-MHz chip based on the 0.25-micron-process technology.

The K7's 128K of L1 cache will provide a higher cache-hit rate than the Pentium II can, and its high-speed, 64-bit backside L2 cache controller will support L2 cache sizes of 512K to 8MB. Intel sells Pentium II Xeon processors with 512K and 1MB of L2 cache. In addition, the K7's 64-bit system interface will support a 200-MHz bus, which is double the speed of Intel's highest-speed bus.

Although the K7's specs are impressive on paper, AMD may have a tough road ahead of it. Essential to the success of any chip are design deals with top vendors and production of sufficient quantities in short order. With AMD's Fab 25 factory already operating and its new Fab 30 factory in Germany waiting in the wings, the latter task should be doable. If AMD produces a high-performance chip that's significantly cheaper than Intel's chips, it could garner important design wins and force Intel to respond.

Windows NT, R.I.P.



to build on the Windows brand.

Microsoft also announced a brand-new product: Windows 2000 Datacenter Server. Targeted at enterprises with large data warehouses, it will support 16-way symmetric multiprocessing.

Call it the end of an era or just notable news in nomenclature, but as of Version 5 Windows NT will be no more. Windows NT Workstation will be Windows 2000 Professional, Windows NT Server 5.0 will be Windows 2000 Server, and Windows NT 5.0 Enterprise Edition will be Windows 2000 Advanced Server. Microsoft grew tired of having the product referred to as "NT" and wants

Beautiful Music?

66%

of respondents to a recent PC Magazine Online poll told us they didn't believe that the online music file format MP3 is a threat to the recording industry. Another 10 percent said they felt that MP3 threatens artists' copyrights, and 24 percent said they hadn't yet heard about MP3.

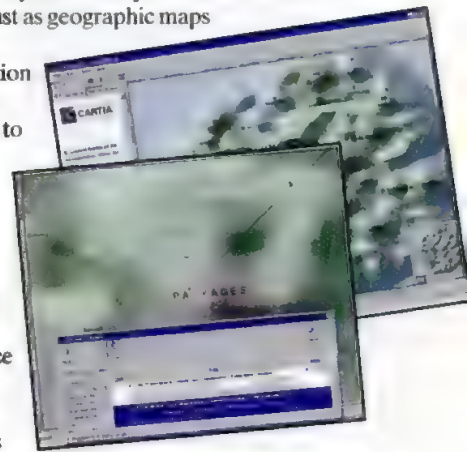
Map Your Way Out

Maps are good for more than just finding the right interstate or the capital of Wisconsin. A new breed of software uses spatial analysis as a fast and easy way to find corporate data buried in a mountain of documents. Just as geographic maps can visually guide you to points of interest, information maps can guide you to the documents most pertinent to your needs.

Spatial-analysis software visually organizes content based on related concepts in documents. ThemeScape's new Cartia was developed originally for government intelligence and was used in the Gulf War to track Iraqi tanks.

More recently, the FBI has used ThemeScape to track missing children. Now available as a commercial product, ThemeScape lets businesses create "enterprise information maps" from a large number of documents—up to half a million, in fact.

For instance, a candy bar company could use ThemeScape to create a map showing how the buying patterns of residents of Hershey, Pennsylvania, are clustered. The cluster would look like a virtual mountain of data in which to drill down. In a recent demonstration of its technology, Cartia fed the Starr Report to ThemeScape, which generated a thematic map in about 2.5 minutes.



Starr map: ThemeScape extracts major themes from documents and clusters similar topics into mountain peaks.

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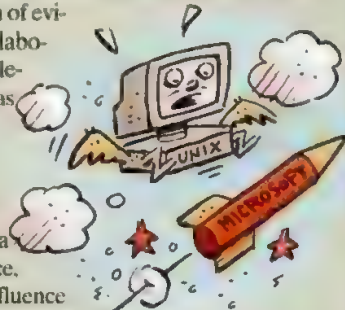
Unix in the Cross Hairs

Microsoft has had its sights set on the Unix market for years now, but it recently stepped up its competitive efforts. The company recently subpoenaed Hewlett-Packard, IBM, Novell, and Oracle officials in search of evidence of anticompetitive collaboration on a unified Unix implementation. And Microsoft has been busy recruiting Unix resellers to promote Windows NT.

According to Microsoft CEO Bill Gates, speaking at a recent developers' conference, the PC platform is gaining influence in the Unix world, and Windows 2000 (formerly known as Windows NT 5.0) is designed to pull much of the Unix market over to the PC platform.

Gates says that over 70 percent of enterprises are basing their intranets on Windows NT running on PC platforms, instead of opting for Unix systems. Hewlett-Packard, Gates noted, was a longtime Unix booster but is increasingly promoting Windows NT.

Not everything is rosy for Microsoft, though. Linux, the freeware version of Unix, has gained serious market momentum. And IBM, Intel, and SCO are out to accelerate the market for enterprise Unix servers. The companies recently agreed that they would aggressively promote SCO's OS UnixWare 7 in enterprises.



Going Gigahertz

When the year 2000 hits, Intel expects to deliver advanced 64-bit processors that run at clock speeds of 1 GHz and over. These 1-GHz rockets won't be cheap—systems will cost from \$5,000 to \$9,000—but they'll include advancements such as more pipelines and new multimedia instructions.

Intel officials confirmed that we'll have to wait until 2000 for the Merced chip, which will be accompanied by a four-way chip set. Arriving in the latter part of 2001, the 64-bit McKinley chip will run at clock speeds over 1 GHz, have an advanced I/O subsystem, and offer a sizable amount of on-board Level 2 cache.

Intel plans to build its 64-bit chips initially on a 0.18-micron-process technology. McKinley will eventually move to a 0.13-micron process. At that point, the chip will be code-named Madison, and it will

also be produced in a less powerful version, called Deerfield, for the volume server market.

On the 32-bit front, a super-pipelined chip code-named Foster is due in late 2000.

Targeted at workstations and servers, Foster will have a new 32-bit microarchitecture and will run at a clock speed of over 1 GHz.

Source: Intel

Millennium Chips

CHIP	TECHNOLOGY	ARRIVAL DATE
Merced	64-bit	1st half of 2000
Foster	32-bit	2nd half of 2000
McKinley	64-bit	2nd half of 2001
Deerfield	64-bit	1st half of 2002
Madison	64-bit	1st half of 2002

ILLUSTRATIONS BY ELWOOD SMITH (LEFT), JACK GALLAGHER (CENTER).

THIS ISSUE'S CONTRIBUTORS: Angela Hickman, Carol Levin, Sebastian Rupley, Carol Venezia, Don Willmott.

Wait-and-See Digital TV

Digital TV is about more than a clear, sharp view of your favorite football team's jersey. A revolution is underway: the convergence of television, cable, and Internet technologies in your living room.

But it's slow going. For many months, more likely years, most television viewers won't experience digital TV. That is, they won't see cinema-quality images on their TV screens. Nor will they interact with programs. In fact, the first digital broadcast won't support true high definition.

"The problem with digital TV, or DTV, is that it means different things to different industries," says Steven Guggenheimer, group product manager for digital television at Microsoft. "To the PC industry, DTV means intelligence and interactivity; to the TV industry, it means better, crisper pictures and better sound. In the end, DTV will mean all of these things, but the underlying infrastructure is still very much under development," he says.

Microsoft is now working on set-top apps that will let you watch what you want when you want, call up instant replays, record on a VCR, send e-mail, and chat online.

Top-Selling Retail Notebooks

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2	Toshiba Tecra 550COT (\$2,945)
3	IBM ThinkPad 380XD M233 (\$2,049)
4	Toshiba Satellite 335CDS M266 (\$1,609)
5	Compaq Presario 1230MGX 233 (\$1,463)
6	IBM ThinkPad 600 PP233 (\$3,006)
7	Toshiba Satellite 4005CDS PP233 (\$1,834)
8	Compaq Armada 1592DMT M166 (\$1,892)
9	Toshiba Satellite 2505CDS M233 (\$1,337)
10	Compaq Presario 1625 K266 (\$1,712)

Source: ZD Market Intelligence. Data for September 1998

Digital Theft

Whether you're a software developer or a songwriter, you create intellectual property that you need to protect from theft in the digital age. Enter firstuse.com (www.firstuse.com), an online service that registers your files and protects them with a digital fingerprint, which could come in very handy if there's ever a dispute about who was the true creator.

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An Invasion of Info Appliances

Worldwide shipments of information appliances (any devices other than PCs that connect to the Internet) will grow about 76 percent annually from 1997 to 2002, predicts market research firm IDC. The lion's share of the market will go to NetTVs, game consoles, and screen phones.



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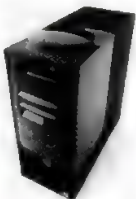
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WINLIST Windows Magazine, 10/98

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PC Magazine, 8/17/98



PC Computing, 10/1/98

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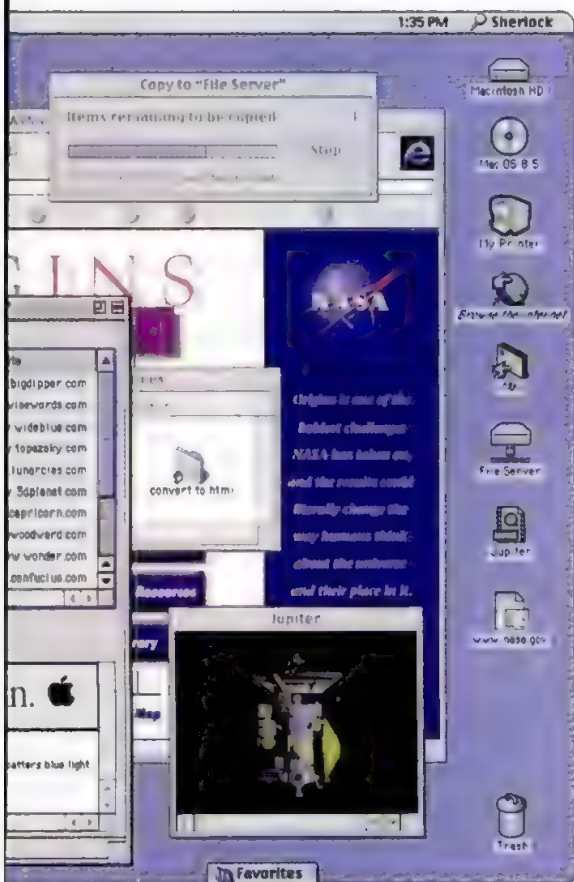
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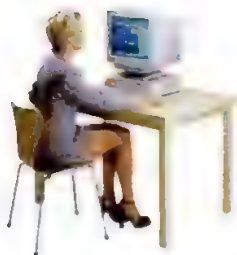
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LETTERS

THE BEST NEW PRINTERS

I loved your printer roundup ("Personal Printers," November 3), but in future printer reviews, would you consider addressing portability for those of us who travel on a regular basis? I'd like to know, for instance, which printer travels best. We inflict a lot of abuse on our printers (we package and ship them all around the world), so our machines turn over frequently. Also, any idea which printers won't drip ink on our rental cars' fabric seats?

JOE TREBING
via the Internet

Once again I find your annual review of printers to be an invaluable buying resource. However, I don't understand why you relegated the photo printers to a skimpy review in the After Hours section, and why you didn't publish their graphics quality and speed specs. I'm currently looking for a printer that can optimize photo quality, as well as print top-quality color text and graphs in a reasonable amount of time. You mention that your Editors' Choice—the Epson Stylus Photo EX—can print color text and graphs, but you don't include any specs on the graphics quality or print speed. I suspect that many other SOHO readers have the same questions.

TOM PILON
Carrollton, TX

USB, RAH!

In "From PDAs to USB Never-Never Land" (October 6), Jim Seymour laments the dearth of available USB devices. I disagree with his assertion that "few truly useful USB devices have appeared." Some very good USB peripherals are out right now, and a few more are imminent. Seymour may not have heard of some of them, because many are disguised behind the older interfaces they support.

Here are some of the ones I've seen and bought lately: the HP DeskJet 895Cse (in my opinion the best ink jet printer), the U.S. Robotics Voice Faxmodem Pro, the Kodak DC260 digital camera, the newest Microsoft keyboard (the Natural Elite) and its latest mouse, and the Intellimouse Pro. Zip Drives will be available with USB by the time you read this. Scanners are just about the only peripherals that don't yet support USB.

FRANCISCO VIGIL
via the Internet

Bill Machrone's column on USB ("The USB Debacle," November 3) was very useful. While I'd heard of USB and knew enough to make sure my new PC came with USB ports, I never really expected to make use of it. Then, while perusing CompuServe's Epson forum a few weeks ago, I stumbled across a

reference to a USB parallel-port adapter. For some time I'd wanted to purchase an Epson PhotoPC 700 but was in a quandary as to how I was going to hook it up. (My HP LaserJet 6MP was on LPT1, and my LPT2 port had my Zip Drive.)

Belkin Components' USB parallel-port adapter saved me. It worked just the way the instructions said it would: The USB drivers loaded with no problem from the supplied disk, and the Epson 700 installed just as easily. (The Epson 700 defaulted to LPT1, so I had to switch it to the USB port.) I wish that all hardware installations were so straightforward and workable. The Epson prints fine from the USB port—as does the HP 6MP.

TERRIE LABARBERA
via the Internet

Any idea which
printers won't drip
ink on our rental
cars' seats?

MORE IMAC ATTACKS

The results of your recent iMac-versus-Pentium II tests ("The Intriguing iMac," October 20, page 56) should, at the very least, wake up some bigwigs at Apple. Making unsubstantiated (or even valid) claims that any Mac is faster than any PC is simply not an effective advertising strategy. Raw processing speed is not that important an issue in the real world.

Face it: A Pentium II/400 is not really any better than a Pentium/233 at most real-world tasks, like writing memos or reading e-mail. So why should someone choose one system over another on the basis of benchmark tests alone? The truth is that PCs are generally less expensive than comparable Macs, and they run a much broader selection of software. Apple is going to have to come up with something more substantive than new packaging or some clever slogans to get users to switch. Purchasing a computer is a business decision, not an emotional one.

DAVID A. KARP
via the Internet

YEAR 2000 CRISIS

Sorry, but I think your Y2K cover story ("What to Do About the Year 2000," October 6) blew it. Your article was thorough in documenting what people need to do to make desktops, servers, software, BIOS chips, and real-time clocks Y2K-compliant, but you missed the fundamental point: Y2K is not a computer problem; it's a business crisis, and it needs to be addressed as such. Granted,

shortsighted computer programming is the cause of such problems, but to get people to deal with the totality of the issue you must talk about the entire economic food chain.

What happens if one particularly important supplier fails to deliver its goods or services at the turn of the millennium? What are the risks we face from a transportation system that can no longer offer same-day service? Do any companies you know have contingency plans in case their failed security systems won't let their employees into the building to reach all of their perfectly year 2000-compliant computers?

PC Magazine is the leading computer magazine in the world, and the main thrust of the information you provide to your readers clearly has to take a PC-centric point of view. But that article leaves the impression that if you fix all of your computer systems, you will be okay. People should know that external forces much larger than they are will impact their homes and businesses at the dawn of the next century. Incorporating a far-reaching and comprehensive strategy to deal with Y2K is in their best interest.

MIKE FLETCHER
Almaty, Kazakhstan

LINUX IS BEST!

All I can do is laugh when I read your stories ("Software Preview," October 20) and letters about how easy it is to set up Linux servers and workstations, and how users should switch from their graphical operating systems to Linux. Wake up! If you can get Linux up and running on your home PC, then use it, but please realize that most users are not that sophisticated. Most want simplicity and ease of use, so a graphical interface that allows them to point and click to access and run all of the most popular applications is what they should use.

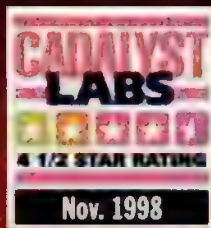
CALVIN MILES
via the Internet

NO VAPORWARE

I appreciate that you are under pressure to give your readers information about Windows NT 5.0 ("Software Preview," October 20). However, Windows NT 5.0 is still vaporware and as such should not be treated as something to which the masses have access. A beta version of any software should not be included in comparisons or reviews with software that has been released as a purchasable entity.



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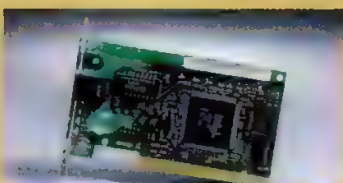
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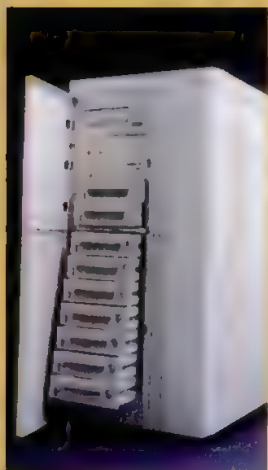
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via the Internet

WHO MAKES WHAT?

Had I been looking to upgrade my monitor, the article "17- and 19-Inch Monitors: Bigger and Better" (October 6) would have been most useful. However, it isn't much help if you're trying to decide on a new, complete PC system. I agree with your "17- and 19-Inch Monitor Buying Guide" that the monitor is one of the essential components of a PC. Thus I was hoping to find information on which PC manufacturers use which reviewed monitors by simply slapping their own labels on them. The usual answer I get in the typical computer store to the question "Who makes the monitor?" is some variation of "I don't know." Next time around, please include such information for us.

CHARLES KERPELMAN
via the Internet

CHEAP AND USELESS

Contrary to Jake Kirchner's position, obsolescence is hardly "the greatest and most intractable problem of personal computing" ("Today's PC: Inexpensive and Obsolete," October 20). He mentioned that all of his other household appliances are 10, 15, or 25 years old, and that they're still okay. They have such longevity because they don't contain a computer, says Kirchner. I would add that the reason he still has them is that they work well and they're reliable. They don't give you unintelligible error messages; they don't crash or reveal vertical learning curves. They just work—day in, day out.

FRANK BREWSTER
via the Internet

How to Contact Us

We welcome your comments and suggestions. When sending e-mail to Letters, please state in the subject line of your message which article or column prompted your response.

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that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.



Corrections and Amplifications

In "What to Do About the Year 2000" (October 6, 1998), we should have identified the BIOS fix provided by Date-A-Fix as a device driver, not a TSR. We sincerely regret this error.

In our October 6 review of 17- and 19-inch monitors, we inaccurately stated that NSA-Hitachi is a separate company from Japan's Hitachi Ltd. Hitachi NSA is actually a subsidiary of Hitachi Ltd. We also inadvertently switched the names of the 17-inch SuperScan Elite 641 and 19-inch SuperScan Elite 751 in the table on page 166 of the Performance Tests section. Also note that the SuperScan Elite 751 does have a pin-cushion balance control; on the Summary of Features table, we stated that it did not.

In our desktop scanner roundup "What's Now, What's Next" (October 20), the features table should indicate that the Epson Expression 636 Artist 2 scanner does indeed support closed-loop calibration.

In our printer roundup "Personal Printers: Great Text, Great Color, Great Price" (November 3), we incorrectly stated that the Canon BJC-50 was a three-color printer and that it required the removal of the black ink cartridge to print in color. In fact, the BJC-50 is a four-color printer with two separate ink tanks that work simultaneously—one for black ink and one for a three-color ink cartridge.

In our November 3 article "The 300-MHz Front Line," we listed WinBook's phone number incorrectly. The correct number is 800-254-7806.

In our November 17 review of e-commerce solutions, we incorrectly characterized NetVenture's ShopBuilder 2.5 as a software-based solution. ShopBuilder 2.5 is an online-only solution; there is no software to install to design or maintain a commerce site. In one instance, we mistakenly referred to the product as ShopSite. A version of ShopSite, Open Market's store design and management tool, was included in one of the other products we reviewed in our story (Netcom Small Business Pack). ShopBuilder and ShopSite are not related.

Jake Kirchner hit the nail on the head in his column "Today's PC: Inexpensive and Obsolete." PC vendors should concentrate on not allowing future products to become obsolete as soon as consumers buy them. Why should I buy something with my hard-earned money when I know that in no time at all, that product is going to be a relic in a museum?

M. GUYZ
via the Internet

I liked what Jake Kirchner had to say in "Today's PC: Inexpensive and Obsolete." Unlike my 12-year-old stereo, whose components I can mix and match and still rely on after all these years, my laptop and PC, which are only two years old, cannot handle many of the applications I use and the tasks I am now required to perform. I think this issue about obsolescence is on many consumers' minds, especially those who cannot afford an upgrade every few years.

ED MONSIVAIS
via the Internet

WIRED, GIRLS

As a PC Magazine subscriber, I was delighted to read Michael J. Miller's column "Classroom Computing" (November 3), in which he describes how dramatically computers have allowed educators to change the teaching process.

My son, Matthew E. Mooney, is currently a freshman at Rensselaer—Miller's alma mater—with a dual major in computer science and computer engineering. Matt, like the entire class of 2002, is all "wired." His only complaint: "Not enough girls!"

JACK MOONEY
via the Internet

BE NICE

The situations Bill Machrone describes in his column "Mind Your Manners" (October 20) are annoying, but they are not representative of what's going on in cyberspace or even at the companies he names specifically. I have two examples that prove my point: Like one of the folks Machrone describes, I use the RoadRunner service for high-speed Internet access. Recently I received, via certified mail, a nasty letter stating that my account had been used to gain "unauthorized access" to several servers. I called RoadRunner directly and spoke with a rep. As it turns out, someone had compromised the firewall I use and then used my service to hack other systems. Several sites around the world, including NASA (one of those .gov domains to which Machrone refers), had been hacked from my computer. My service was not disconnected immediately; I still have it. Instead, I worked with RoadRunner to figure out what had happened and was warned that future uses like this would have to result in cancellation of my service. I have since re-secured that firewall, and all appears to be well. Some feathers got ruffled, but life did go on and I kept my service.

Second, I received some rather nasty personal e-mail from someone using a Hotmail account. I reported the abuse to Hotmail in an attempt to have the mail cease. Hotmail then required me to show some proof that the letter originated from the suggested party. I did, and the account was canceled—but not solely because of my complaint. The account was canceled because its use was in clear violation of Hotmail's terms of service, and I was able to prove that the sender did it. This all seems to be fair discretion on the part of ISPs.

DANIEL M. POMERANTZ
via the Internet

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Flysight

Research in computer vision may help computers of the future to see.

Consider the blowfly. NEC research scientist Rob de Ruyter van Steveninck certainly does. In one corner of his lab—located at NEC Research Institute in Princeton, New Jersey—a common blowfly is hanging out, sipping sugar water and watching the tube. A monitor is displaying a slightly changing pattern of lines.

Nearby, an oscilloscope displays the electrical pulses recorded by an electrode that taps into a single nerve cell in the fly's brain. As the pattern of lines moves across the fly's visual field, the on-screen waveforms fluctuate, synchronized to the audible crackle of radio static. If you pass your hand from left to right in front of the fly, the nerve cell's signal spikes, amplified visually and audibly by the equipment. Pass your hand right to left and the visual and audible signals are quiet—evidence of the fly's capacity to distinguish among different types of visual data.

What does a semiconductor company hope to learn from studying the sophisticated motion-detection and visual measurement systems of the blowfly? Understanding these systems may help scientists there figure out how computers may one day process visual information efficiently—a task for which the acrobatic blowfly is optimized. NEC is at the forefront of developing machine vision systems that may eventually enable computers to see.

Each fly eye is an array of 5,000 lenses, each with eight photoreceptors that are among the fastest known in the animal kingdom. Similar to a charge-coupled device (CCD) camera, the eye converts fluctuations in light intensity into electrical responses. The fly then processes the information, measuring velocity and sending



instructions to its flight gear. The insect-vision team at NEC is trying to figure out how accurately the fly extracts visual information and encodes the information in its pixel array. The principles they're learning may one day be useful in developing artificial-vision applications.

DETECTING MOTION

NEC research scientist Jeffrey Mark Siskind is attacking the computing vision problem from another angle—motion detection. He has developed a computer system that identifies not just objects but also seven simple events, such as when he picks up a colored block, puts it down, and tips it over. It sounds rather mundane, but the potential applications are, in fact, extraordinary. One application Siskind envisions could help blind people navigate their environments.

In his lab, a camera hooked up to a PC records video for 3 seconds, during which time he tips over a block. The system has two trackers—one for color and one for motion—which record the relative and absolute positioning of the hand and the block. The system breaks down the momentous event into numerous steps and compares the positioning information with previously recorded events to identify the event accurately.

Ultimately, the technology may show up in smart glasses equipped with a camera that would feed image information to a processor, recognize events, and deliver an audible feed to a set of headphones that would describe the surrounding environment. The technology could also be used to train industrial robots to perform tasks by watching and then replicating tasks. And a smart conference room equipped with such technology would recognize a new speaker and automatically start the person's presentation.

The objective of Siskind's research is to endow computers with some of the expertise that humans have. "What allows us to describe the world in ordinary language?" he asks. His goal is to codify that understanding and enable computers to learn. "Kids watch and learn to correlate between language and what they see," he says. The ultimate goal, he explains, is to make the computer more reflective of the human.

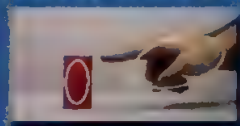
Motion detection and computer vision are also subjects of research activities at IBM and Microsoft. Microsoft's research lab is working on incorporating gesture recognition into a future interface. And IBM has already demonstrated an interface that interprets gestures.—Carol Levin

Pushover

NEC's research in machine vision has produced a system that recognizes seven simple actions. In this tip-over event, a camera records 3 sec-

onds of video, draws ellipses around the hand and block, and tracks their positioning. The computer then compares the values with models from previously recorded video, and it

chooses the best match. Eventually, the technology could be used to train industrial robots and to make smart glasses that would verbally describe surroundings for blind people.



Source: NEC

The XML Infusion

According to Microsoft CEO Bill Gates, speaking at the company's recent Professional Developer's Conference, Extensible Markup Language (XML) will be an integral part of Microsoft's operating systems and browser. Microsoft has been actively involved in setting standards for tagging data stored on the Web, and several XML standards—including XML 1.0, Extensible Style Language (XSL), XML Document Object Model (DOM), and XML Namespaces—will be included in Internet Explorer 5.0 and versions of Microsoft Windows.

XML is an important new complement to such architectural underpinnings of the Web as Java and HTML. XML is designed to tag the locations of critical information in Web documents. Based on elements such as text parsing, tree management, and formatting, XML tagging is an advanced card catalog for a library of Web pages.

For example, you might XML-tag a page containing the complete text of a book so that a search engine or database could search on



precise passages in it. Information in HTML-based table format on the Web now will also be XML-tagged, so spreadsheets and databases will be able to import and sort such tables easily, without losing formatting.

Building XML support into Windows will mean that the OS can be used on the server side to exchange data between application servers on various platforms, and that programmers can build more flexibility into applications and components designed to exchange XML-tagged data.

The standard way to access database data on the Web now is to use a database application designed to work with a particular data format. According to Gates, though, XML features in browsers, operating systems, and applications can help make database access independent of specific applications. "We want to make database access independent of what kind of data you're going after," says Gates. "XML standards can allow for the rich, semantic-level connections we need to do that."

IBM also has XML on the radar. It's showing a product that does *transcoding*: tagging data automatically with XML as soon as a network call is made for the data.—Sebastian Rupley



Though the personal computer is far more tractable today than ever before, it can still be frightfully difficult to deal with—especially if you're a first-time buyer accustomed to the relative ease of using a microwave or VCR. In the view of many of the industry's leading players, this is the main reason that so many American homes (60 percent, by some estimates) still don't have PCs.

After Microsoft publicly castigated its own ease-of-use efforts at this year's Windows Hardware Engineering Conference (WinHEC) and Intel came to our offices this summer suggesting an "ease-of-use benchmark test," we at PC Magazine Labs normalized our method of judging how easily an inexperienced user can set up, operate, upgrade, and service a system. For this issue's roundup "Home PCs," we put all 24 machines through a script with over 200 steps, systematically grading their ease of use.

The results were astoundingly bad. Grading each machine with one of four marks (poor, fair, good, and excellent) according to its ability to handle the script, we rated 11 as poor, 11 as fair, 2 as good, and not a single one as excellent.

The script was divided into three major sections: setup (40 percent of the final score), learning/usability (20 percent), and troubleshooting/support (40 percent). Each section contained anywhere from three to six major subgroups, which in turn contained dozens of specific questions. Within the setup section, for instance, the subgroup "ports and cables" listed questions such as "Are the ports in

the rear of the system color-coded to match the system's cables?"

For each subgroup, we tabulated the percentage of questions receiving "yes" answers and weighted this number according to the importance of the subgroup. For instance, within the setup section, the subgroup for visual setup guides received a high weighting, while the "ports and cables" subgroup received a slightly lower weighting. We then gave ratings within each section and finally tabulated an overall rating.

Only the Compaq Presario 5600 Series and the HP Pavilion 8390 came away with a respectable overall score—a good—

though even they could use some improvement. The Presario offers a detailed troubleshooting guide, multimedia buttons on its keyboard, and superb service and support; but the system lacks software-based documentation and comes with a less-than-ideal setup poster.

Though the HP machine's troubleshooting guide is a bit scant and the design of its rear bus slots complicates upgrading, it did well in most other respects, scoring just below the Compaq PC. Many machines received *fair* ratings, but just as many garnered a *poor*, including stark, unfriendly systems from CompUSA, Micron, MidWest Micro, Pionex, and Quantex.

Our new script may seem intricate, but it's fair and reliable, reaffirming what we've always thought about ease of use. Home PC manufacturers should spend less on performance and storage space and more on making machines user-friendly.—Cade Metz

Ease of Use Is Hard to Find

A HOME PC CHECKLIST

- ✓ **VISUAL SETUP GUIDE.** A box-topper, poster, or videotape that explains how to set the machine up.
- ✓ **Labeled I/O ports.** Input/output ports identified with plain English text.
- ✓ **COLOR-CODED CABLES** to match the appropriate I/O ports.
- ✓ **INTERNET SETUP WIZARD.** A software interface that guides you through the process of first connecting to the Internet.
- ✓ **A PRINTED USER GUIDE** that provides detailed information on how to use, upgrade, and repair the system.
- ✓ **SOFTWARE-BASED USER GUIDE AND HELP TOOLS.** Easily accessed and searched software that helps you use, upgrade, and repair the system.
- ✓ **RECOVERY DISK.** A CD-ROM that returns the machine to its original software settings should you encounter irreparable problems or failure.
- ✓ **EXTENSIVE SERVICE AND SUPPORT.** A one-year manufacturer's warranty as well as round-the-clock technical support over the phone and via the Web.
- ✓ **ROOM FOR EXPANSION.** As a minimum, a free PCI slot, a free front-accessible drive bay, and a free IRQ.

RESEARCH

Welcome to Carbon Valley

Some scientists are beginning to get attention for a completely new approach to making computer circuits cheaper, smaller, and faster: carbon nanotubes. Discovered seven years ago by Sumio Iijima, carbon nanotubes are just a fraction of a nanometer in width (a nanometer is one-billionth of a meter) and can be up to 100 micrometers long.

Most interesting from a computer designer's standpoint are nanotubes' electrical- and heat-conducting capabilities. Nanotubes can act as excellent conductors; they can also play the role of semiconductors, as silicon does. And they're better heat conductors than any other known material.

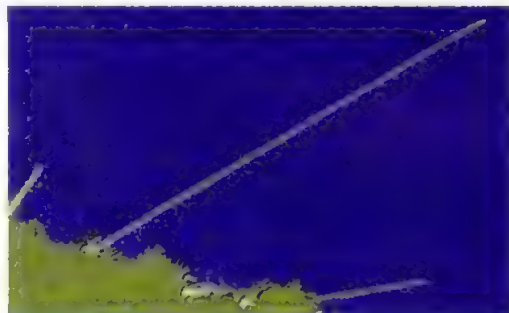
These properties suggest that carbon nanotubes may make it possible to shrink current computer designs down to the molecular level,

without falling prey to the problems that prevent existing materials from functioning at such small size. This would let computers be millions of times as powerful as they are today.

Until recently, this type of technology seemed to be decades away. But Professor Z. L. Wang of the School of Materials Science and Engineering at the Georgia Institute of Technology and Walter de Heer, a physics professor at GIT, recently published some promising results from their research into nanotubes, in which they were able to demonstrate *ballistic conductance* at room temperature. In contrast, the best superconductors need to be supercooled to hundreds of degrees below 0 to achieve similar current densities.

Are the properties of carbon nano-

tubes too good to be true? Some scientists are worried that carbon nanotubes may pose an environmental hazard. This worry is based on the carbon nanotubes' similarity in shape to asbestos fibers, which are known carcinogens. Until these concerns have been properly investigated, researchers are exercising caution in their laboratories.—*Marc M. Groz*



GOING BALLISTIC: Electrons pass through this single carbon nanotube without generating heat. This technique lets large electrical currents flow through extremely tiny devices and may one day be used to build ultrasmall devices.

Web Bunkum and Bafflegas

Every advance in personal computing is accompanied by an increase in jargon. Inevitably, new technologies require new terms to describe them. The Internet is no exception.

The Internet has done so much to boost the PC industry that I suppose it's only fair that the new technologies and products have created a mother lode of new assignments for the industry's public relations practitioners. In short order, they have churned out thousands of press releases heralding the arrival of supposedly hot new products.

Unfortunately for those of us who have to wade through these releases, it sometimes seems the PR writers have been playing a game of random buzzword creation. You've probably seen this game, which features three lists of industry and technology terms. You select one word from each list to create new, realistic-sounding computer terms, such as "bissynchronous symmetric processing" or "standards-based interactive Web chat."

Well, enough is enough. Today I'm fighting back. I pieced together the following mock press release from sentences taken verbatim from ten actual press releases, which I chose at random from hundreds issued at a recent Internet show in New York.

Jargon Software Inc. Announces JargonWare 1.0™

Information access tool solves "info-source glut" dilemma.

NEW YORK, DECEMBER 1, 1998—Jargon Software Inc. today announced the immediate commercial availability of JargonWare 1.0tm, a tool that empowers individuals and companies

so they can quickly target and access the knowledge they need for strategic or competitive reasons. Geared toward enterprises in search of alternatives to fat-client, standalone-desktop environments, JargonWare 1.0™ provides an easy-to-administer suite of intranet/extranet solutions that can be accessed by any Java-enabled client.

The only high-performance application to combine the scalability, reliability, security, and manageability needed to deploy enterprise Web applications with a fully integrated, high-productivity development environment, JargonWare 1.0™ helps companies eliminate enterprise complexity by seamlessly integrating and correlating information buried in legacy data sources and customized or prepackaged applications.

JargonWare 1.0™ creates a seamless integration between SQL, e-mail, MS Office, HTML, PDF, legacy, spreadsheet, Lotus Domino, and external Web sites. In order to provide high performance and scalability, and to leverage a rich set of communication patterns beyond what is available in systems on synchronous RPCs, the JargonWare 1.0tm API takes advantage of an interprocess communication model that uses the metaphor of e-mail.

The product's client/server technology combines a 100% Java viewer applet with an optimized, server-based image manipulation engine, using architecture that optimizes overall image-display performance and reduces client systems' memory requirements. JargonWare 1.0™ features include auto-generation of JavaScript and VBScripts for publishing to HTML templates for Microsoft Internet Explorer and Netscape Navigator, the ability to export to RealVideo, support for events, and visual indication of hot spots.

Jargon Software Inc.'s products and technologies help businesses and consumers add value to their computer investments, as well as extend and broaden their ability to communicate their ideas, needs, and information. Perhaps even more remarkable than the JargonWare technology is the fact that Jargon Software Inc. exists at all.



Jake Kirchner

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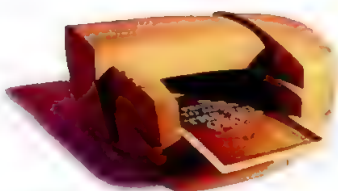
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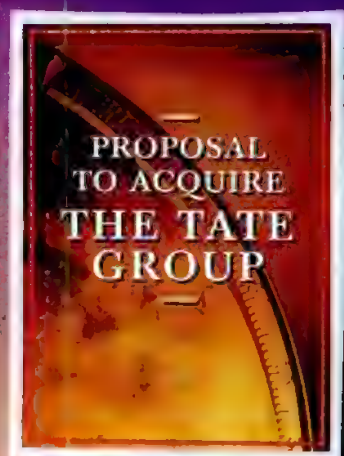
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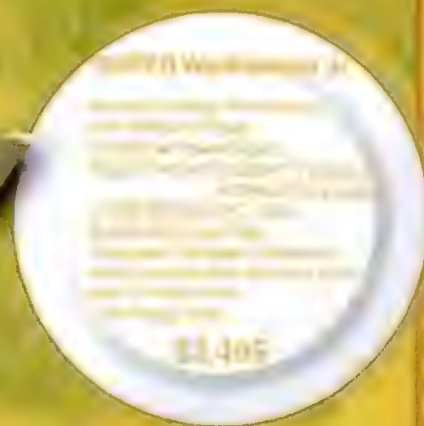
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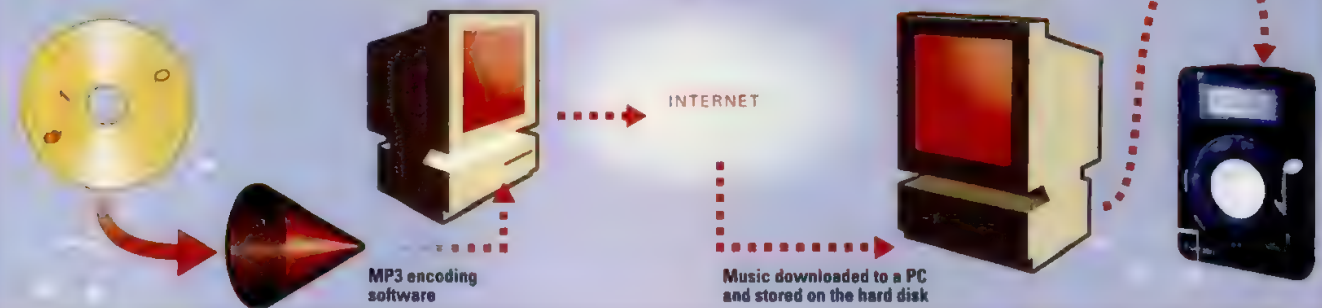


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MP3 Music to Go

Music industry execs charge that the Diamond Rio, a portable MP3 player, violates the Audio Home Recording Act. The music industry wants consumers to pay for the music they play on it. Diamond claims that the Rio simply plays audio that is already stored on a computer's hard disk.



WEB TUNES

Online Music Chaos: Blame It on Rio

MPEG-1, Layer 3 (MP3)—the popular file format for compressing and playing CD-quality music—has provoked a battle over copyrights that could determine the course of music distribution via the Internet, and you can blame it on Rio.

Both the Recording Industry Association of America (RIAA) and Diamond Multimedia agree that MP3 is a significant technology for the music industry, but each claims the other is hurting the fledgling MP3 market. The RIAA believes the illegal distribution of MP3-compressed music via the Internet will ruin the online digital-music market, so it recently asked the courts to block Diamond Multimedia from distributing the Rio PMP300, a \$199 portable MP3 player. The RIAA was turned down but has already filed an appeal to that decision. The appeals process is expected to take several months, so its outcome shouldn't impact the Rio's release date in late November.

The ease of producing MP3 song files is one reason unsigned artists are so enamored of MP3 while the recording industry is afraid of it. To format songs from a CD, the first step is installing MP3-formatting software on your PC. (You can download MusicMatch Jukebox from MP3.com, a music site.) The software has you select songs to encode, then click a Start button. All that's left is to add the formatted songs to your MP3 music database.

The Internet is a haven where musicians can get their music heard. And it's simple for a listener to get free MP3 playback software on the Web and make a PC into an excellent jukebox—so excellent, in fact, that music executives see a doomsday scenario where Mariah Carey will sell just a single CD to an entire university.

To illustrate, an RIAA search found 80 MP3 sites on the Web with 20,000 song files, almost all unlicensed. Why go after Diamond Multimedia, though? Because, says RIAA president and CEO Hilary Rosen, Diamond wouldn't postpone the Rio's launch until further discussions with the RIAA about copyright laws, and because it can profit from illegal music distribution—music that the Rio helps users copy.

NETWORKING

Here a Network, There a Network

With an eye toward a world full of easily networked, Java-enabled telephones, pagers, and other consumer devices, Sun Microsystems has bought a consumer software maker called Beduin Communications. Beduin's flagship product is Impact, a browser for consumer devices. The browser is far smaller than standard ones and incorporates telephony features that let you automatically dial a phone number by clicking on a Web page.

Sun's move is another step toward its goal of making easily networked consumer devices of all kinds (not just computers) ubiquitous, along with plug-and-play network connections. Microsoft has a similar concept in the works.

Sun plans to implement Beduin's technology first in Web-connected phones. The acquisition is to fit in with JINI (pronounced "genie")—Sun's Java-based software technol-

The RIAA says: "MP3 recording devices are governed by 1992's Audio Home Recording Act, and the Rio does not comply with it, because it is not registered with the Copyright Office; it does not pay royalties; and it does not incorporate SCMS, which prevents serial copying."

Diamond Multimedia's Web site says it's legal to make MP3 copies of your own CDs but "illegal to code MP3s and distribute them to others unless you have permission from the copyright holder of the music."

—Angela Hickman and Don Willmott

ogy for making the network connection of devices as easy as plugging a phone in and getting a dial tone. Sun calls the idea Webtone.

CEO Bill Gates has discussed a concept equivalent to Webtone, which he calls Wintone. His vision of Wintone revolves around an all-powerful server that anyone with an Internet connection could rely on for managing and updating information on Windows-based devices.

Wintone depends on the idea of network connections that are as easily established as getting a dial tone on a phone. This concept could have a big impact on the future of Windows and Windows CE. The Windows 98 feature Windows Update could evolve into a one-step network connection that would trigger, say, automatic bug fixes and driver upgrades. And it would all come automatically with the network dial tone.—Sebastian Rupley



PHONE BROWSER: Beduin's first product will be a compact browser.

Microsoft vs. RealNetworks

Once highly fragmented, the streaming-media market has evolved into a race between Microsoft's NetShow Services and RealNetworks' G2 technology. At stake is ownership of the Internet's multimedia architecture, a jewel seemingly too valuable for Microsoft to relinquish.

Web surfers should download both players, since some Web sites post their video clips in only one or the other format. Not doing so would be like randomly disabling channels on your television. Developers, faced with a harder decision, should remember that while free is always good—NetShow is free—it's seldom best. Today, RealNetworks offers the best solution for streaming-media developers.

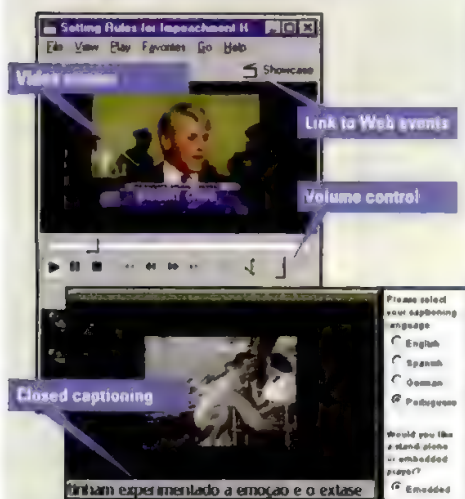
For many Web site developers, NetShow's free tools for streaming audio and video should suffice. But for those developers seeking the most compelling presentation of video at 28.8 Kbps or the integration of streaming media with distance learning, virtual classroom, and groupware applications, G2 is better qualified.

AUDIO/VIDEO QUALITY: Though one technology may prove superior in limited experiments, tested across a range of video clips and bandwidths both offer equivalent audio and video quality.

Microsoft NetShow 3.0

www.microsoft.com

- Multiple-format support
- Live PowerPoint support
- Free player
- Free server with Windows NT



OTHER MEDIA SUPPORT: The challenge for most Internet broadcasters is creating a high-quality experience at 28.8 Kbps. This is the primary focus of Real's G2 technology, which debuts the RealPix and RealTex formats as well as Synchronized Multimedia Integration Language (SMIL). SMIL is an XML-based language that defines how to create integrated presentations combining linked text, audio, video, still images, and Flash animations. It also enables pans, zooms, fades, and transitions between these elements.

Microsoft supports streaming JPEG images with audio but without special effects. NetShow's key strength, the ability to produce live PowerPoint presentations with streaming audio, has limited applicability.

PLAYERS: RealPlayer G2 offers more features than Media Player. The free RealPlayer debuts filtering and Frame Rate Up-sampling—features that improve the perceived quality of streaming video.

Pay \$29 for RealPlayer Plus and you'll get extra features such as brightness, contrast, and color controls; scanning and recording selected audio and video; and one-touch presets for favorite sites.

Microsoft's and RealNetworks' products can both automatically download playback components for new technologies as they emerge. RealNetworks uses this feature to support AVI, WAV, MIDI, and MPEG-1, but not NetShow files. Media Player supports more formats but can't play RealSystem 5.0 or G2 files.

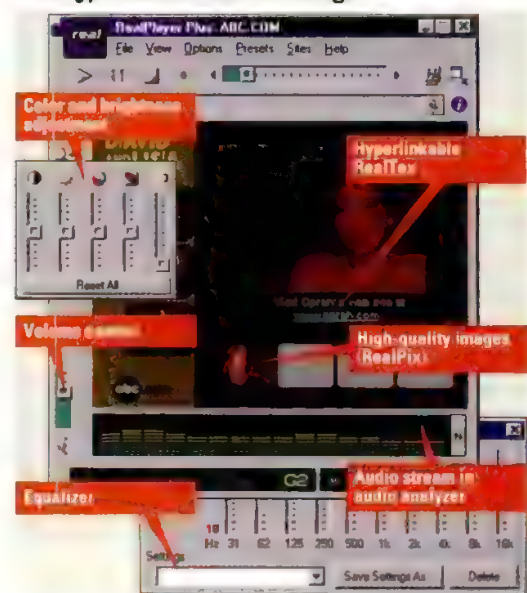
G2 is easier to integrate with virtual-classroom applications from Centra and DataBeam, online courseware apps from Asymetrix and Macromedia, and Lotus Notes' groupware apps. Any advantage RealNetworks has in this area, though, is likely to be short-lived.

SERVER SOFTWARE: Both products limit the use of outbound bandwidth and support live and multicast transmissions.

RealNetworks' RealPlayer Plus G2

www.real.com

- Client-side special effects
- More polished developer tools
- Advanced player options
- Free basic player; \$29 for Plus G2
- Hyperlinkable text and images



And both offer scalable streaming, which adjusts performance to changing line conditions. G2's use of one file for all streams is a welcome convenience.

On the commerce front, both products offer advertising insertion, branding opportunities, and password-protection. NetShow offers better integration with Site Server and other Windows NT services—enabling, for example, Internet pay-per-view events. Either server is acceptable for mainstream applications.

ENCODING TOOLS: RealNetworks' basic audio and video encoders are better designed and easier to use than Microsoft's. RealNetworks has yet to deliver easy-to-use SMIL encoding tools.

PRICE: Microsoft's strongest advantage is price, since NetShow is a free component of Windows NT Server. Though RealNetworks offers free Internet and intranet server software, you'll have to pay once usage expands beyond a limited number of clients. —Jan Ozer



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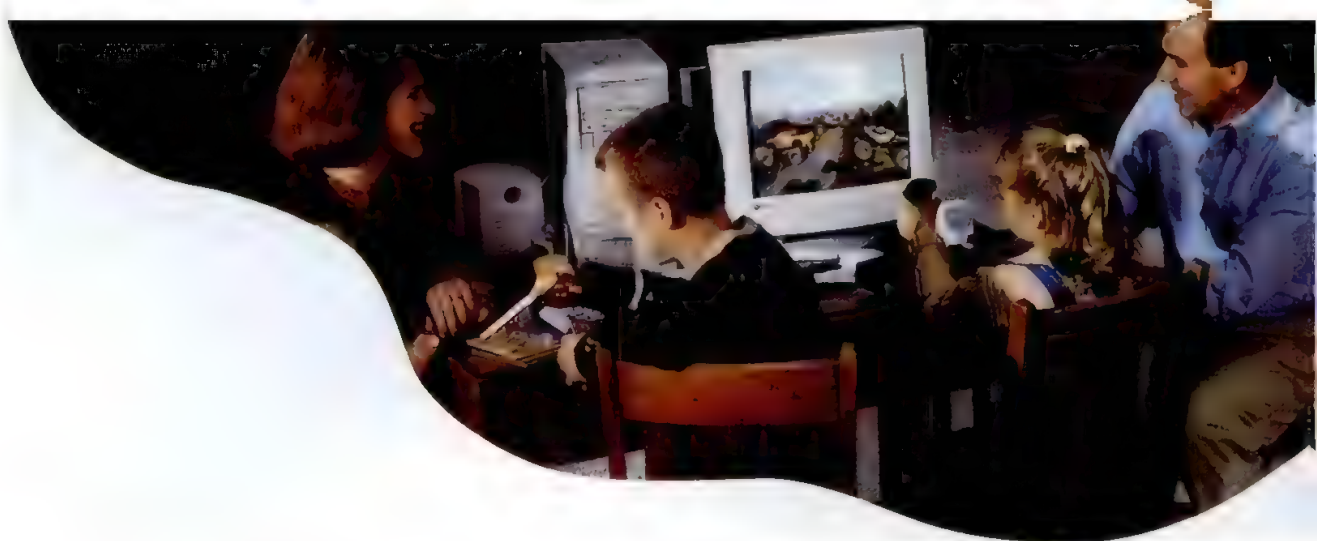


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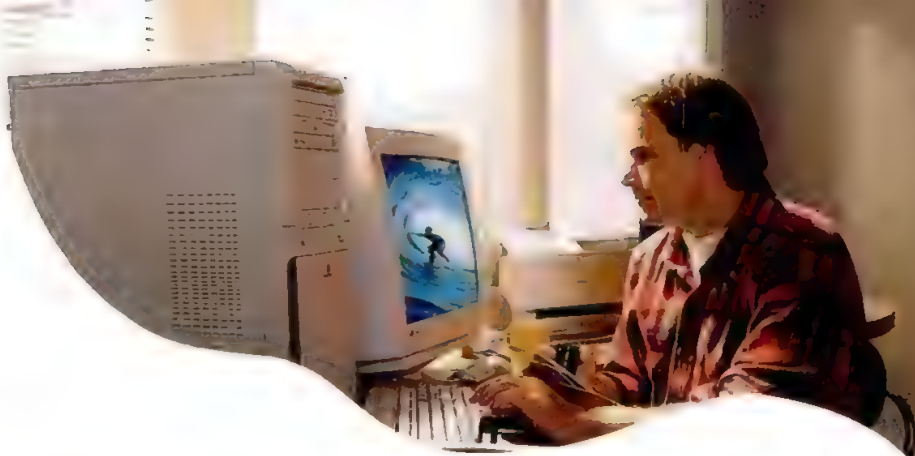


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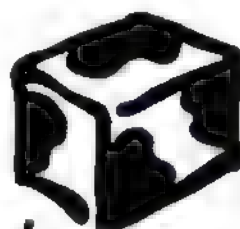
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Latest and Greatest: Color Laser Printers

Four new color lasers printers—including two first-ever tabloid-size units—are outfitted for your network at more affordable prices.

By M. David Stone

Are you wondering whether color will ever become a mainstream staple of business printing? The latest crop of color lasers will help erase your doubts. In the last year or so, color laser printers have reached the point of offering high-quality output—in monochrome or color—for text, graphics, and photos. The newest printers, which we review here, offer that high output quality at substantially lower prices.

Even better, the new generation of color laser engines (as represented by three of the four printers reviewed here) offers duplexing—an important feature for any workgroup

printer. And for the first time, you can find color lasers for tabloid-size printing with prices as low as \$5,000. That's not much more than the price of a letter-size color laser just one year ago.

THE CONTENDERS

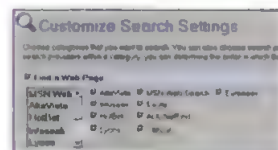
The four printers we tested for this miniroundup include two letter-size printers, the HP Color LaserJet 4500 DN and the Tektronix Phaser 740 Extended, and two tabloid-size printers, the HP Color LaserJet 8500 N and the Lexmark Optra Color 1200n. In addition, we looked at a preproduction version of the Tektronix Phaser 840 Plus (\$3,200 street; see the sidebar on page 44). Testing these four printers was challenging,

because of the variety of different functions that each one can perform. Because all four came equipped with Ethernet adapters, we looked not only at color and monochrome output quality, but we also tested each for speed.

To test speed in printing both text and graphics, we used a subset of our printer test suite developed by PC Labs (for complete information on these tests, see the "How We Tested" section of the printer roundup in our issue of November 3, 1998). We ran the printers through their paces on our Microsoft Word Text test (with a 1-page document and a 12-page document), as well as tests using Microsoft Excel, Adobe Photoshop, and PowerPoint.

GET YOUR IE 5 BETA NOW:

Attention, download junkies: Microsoft has released the first public beta of its long-awaited



Internet Explorer 5 browser. **Page 48.**

NOTE TO SELF:

Use Dragon's NaturallySpeaking Mobile to record your notes on the road and forget about transcribing them when you get back to the office. **Page 51.**



ETHERNET ON THE CHEAP:

PC Labs tests three new multiport server network interface cards that can be cost-effective alternatives to Gigabit. **Page 76.**



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HP Color LaserJet 4500 DN

Hewlett-Packard is well known for its monochrome laser printers, but its efforts on the color laser front have been wanting. That's just changed, however, thanks to the double whammy of the letter-size HP Color LaserJet 4500 series (starting at \$2,500 street) and the tabloid-size HP Color LaserJet 8500 series (starting at \$6,000), which we cover separately in this roundup.

The HP Color LaserJet 4500 series comes in three versions: The 4500 (\$2,500) is the base printer, with 32MB of RAM and two paper trays—for 150 sheets and 250 sheets. The 4500 N (\$2,950) offers 64MB of RAM and adds an integrated fast Ethernet adapter. The 4500 DN (\$3,800) adds a 500-sheet paper feeder/duplexer that are options for the other two models. We tested the 4500 DN.

Setting up this printer was straightforward. The 500-sheet paper feeder/duplexing unit fit under the printer. You just need to stack them and connect one power cord between the duplexer and the printer, then install the imaging drum, paper, and four toner cartridges. Installing the cartridges is less convenient than it should be, because you have to close the printer and wait for the carousel to turn between installing one cartridge and the next. That's a minor issue, however.

The setup program installs drivers for both PCL 5c and PostScript Level 2. We used the PCL driver for all our tests, as suggested by HP. The driver gets high marks for ease of use, thanks to the ColorSmart II technology, which HP has borrowed from its ink jet printer line. You can turn ColorSmart off and set various options manually, but the feature does a re-

markably good job of automatically picking the right dithering scheme, color corrections, and so on. We ran all our tests in automatic mode.

The printer's output at the maximum 600 dpi was generally excellent, except for a slight misregistration, or inability to line up the colors. A cyan circle surrounded by black, for example,



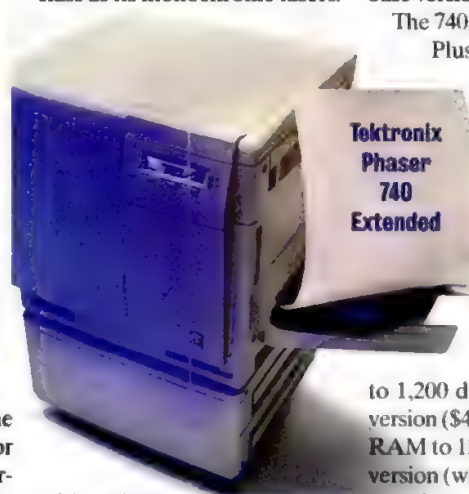
Street price: \$3,800
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left a thin slice of white to one side of the circle. Text on a color background was similarly surrounded by a white shadow in some cases, making the text difficult to read.

On the other hand, text and graphics had crisp, clean edges, colors were fully saturated, and most test photos were near-photographic quality. The exception was a black-and-white photo, which showed streaking in areas of subtle shading and a ghost image of a white area in a dark background. In short, most output earns high praise, but there are exceptions.

The 4500 DN's performance scores were mixed. Rated at 16 ppm for monochrome and 4 ppm for color, it printed our 12-page Microsoft Word test document at better than 10 ppm but took about 27 seconds to print a

1-page document. For color output, the unit printed a 2-page Microsoft Excel document consisting of color graphs in 56 seconds, a 6-slide Microsoft PowerPoint presentation in a bit over 4 minutes on paper, and a full-page photo from Adobe Photoshop in about 7.5 minutes. Considering the output quality, the speed for photos is remarkable. We didn't time a duplexing job, but the feature worked without problems. Count the 4500 DN as a noteworthy new choice in color laser printing, which finally puts HP's color lasers in the same class as its monochrome lasers.



Street price: \$4,200
Tektronix Inc.,
Wilsonville, OR;
800-835-8100
www.tektronix.com/color_printers
421 at www.pcmag.com/infoclink

with 64MB of RAM to boost resolution from 600 to 1,200 dpi, and an Extended version (\$4,200), which raises the RAM to 128MB. The Extended version (which we tested for this roundup) adds an external hard disk, as well as an Automatic Duplex and Lower Tray assembly; both parts are available as options for the other models.

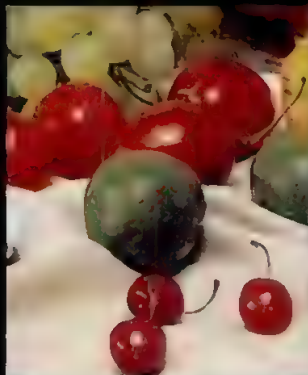
Tektronix laser printers have historically been the easiest color lasers to set up. The 740 series, based on a new-generation version of the same engine design, retains that lead. There's little more to do than stack the printer on top of the lower tray assembly, open the printer's front door, slide in the four toner cartridges, and install the PostScript 3 driver. To set up the printer for duplexing, replace one of the paper drawers with a duplexing tray and choose duplexing in the driver. Note that the driver installs with a default setting of Au-

Although the base-price version is more expensive than the Tektronix Phaser 740—its direct competition—it's a close match in quality and performance. And the ColorSmart feature in the driver makes printing color output as easy as it gets.

Tektronix Phaser 740 Extended

Tektronix has been at least as dominant a force in high-end color printers as Hewlett-Packard has been in monochrome lasers, leading the pack for years. The letter-size Tektronix Phaser 740 series represents the company's move into a far more mainstream market—

Comparing Color Output Quality



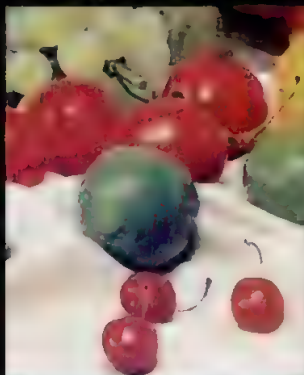
HP COLOR LASERJET 4500 DN

Note that the lime's skin loses detail, and that the fruit has a flat look, indicating a loss of subtle variations in color.



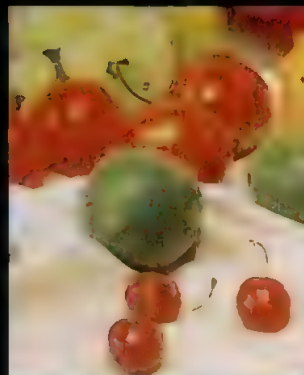
TEKTRONIX PHASER 740 EXTENDED

The 1,200-dpi resolution shows fine detail in the lime's skin. Note, too, the sense of roundness in the fruit.



HP COLOR LASERJET 8500 N

This output looks slightly flat. Misregistration shows as a thin yellow line along the upper left edge of both limes.



LEXMARK OPTRA COLOR 1200N

The Lexmark output is significantly flattened and shows obvious misregistration as a yellow half-ring around the larger lime.

automatic for color correction.

Output quality was the best on our tests. The HP 4500 DN's output was slightly better in one test photo, but the 740 Extended was more consistent, and it didn't turn up any flaws like the 4500 DN's misregistration. Edges on text and on lines in graphics were suitably crisp, colors were fully saturated, and all of the test photos were near-photographic quality at 1,200 dpi.

As with the HP 4500 DN, performance scores for the 740 Extended were a mixed bag. The Tektronix unit essentially tied the HP printer for Word at over 10 ppm for our 12-page test document and came in at about 28 seconds for our 1-page document. The 740 Extended also tied on our two-page Excel document, at 56 seconds. It printed the PowerPoint slides in about half the time taken by the HP unit, at just over 2 minutes, however.

The 740 Extended took much longer than the 4500 DN for our test photo, at 18.6 minutes, but note that, at 1,200 dpi, the Tektronix printer was set for its best mode. At 600 dpi it would have been faster, but image quality would have suffered. The duplexing feature worked as promised.

Tektronix says it has upgraded its network management

software significantly since our last roundup of network printers; however, we didn't test the printer on a network for this story. In any case, with the 740 series, Tektronix can still claim the lead in output quality and in the combination of output quality and performance. And it's certainly the most printer for the price. Keep in mind, too, that if you're not ready to pay for color yet, the 740L will let you buy a 16-ppm monochrome printer today and upgrade to color tomorrow.

HP Color LaserJet 8500 N

As already suggested, the Hewlett-Packard Color LaserJet 8500 series falls in the same high-quality printer category as the HP Color LaserJet 4500 series. Priced at \$6,000 (street) for the base model, the 8500 series can handle paper up to 11.7- by 18.1-inches. The 8500 series is also the only tabloid-size color laser yet announced with an optional duplexer.

The base version of the 8500 includes 32MB of RAM, a 100-sheet input tray, and two 500-sheet input trays. The 8500 N (\$6,800 street), which we tested for this roundup, adds a Fast

Ethernet connector. HP also offers a third version, the 8500 DN (\$8,700) with 64MB of RAM, plus a 2,000-sheet input tray and duplexer standard.

Setup is surprisingly simple for such a large printer. The unit, which is about the size of R2D2, rolls out of its shipping crate already assembled and mounted

on wheels. Simply roll it to its spot, lock the wheels, and load the drum, toner cartridges, and paper, then install the driver. As tested, the 8500 N came with only a PostScript 3 driver. Hewlett-Packard expects to provide a PCL 5 driver in early 1999. As with the 4500 DN, the 8500 N driver offers Color-

Smart, set to automatic by default.

And, of course, it uses the same network management software.

Output was similar in quality

to output from the 4500 DN, complete with a slight misregistration problem, which affected some graphics. Edges in text and graphics were sharp, colors were suitably saturated, and our test photos were near-photographic quality. The monochrome image showed some streaks—but not the ghost image that turned up in the 4500 DN's output. As with the 4500 DN, the top resolution is 600 dpi.

The 8500 N's performance was on the slow side for a unit meant as a departmental printer. Although the engine is rated at 24 ppm, it performed below 10 ppm on our Word tests for the 12-page document and took a



Street price: \$6,800

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FIRST LOOKS

long 42 seconds to print a 1-page document. HP says that the printer will come closer to its rated speed with larger documents. Note that our results for the 12-page document are consistent with printing the first page in about 40 seconds and the rest of the document at 24 ppm.

Rated at 6 ppm for color, the 8500 N took slightly over a minute for the two-page Excel document with graphs and a surprisingly long 35 minutes to print the PowerPoint presentation. The test photo from Photoshop took a substantial 25 minutes. We didn't test duplexing, since HP didn't provide the duplexing option with our test unit, but we tested with tabloid-size as well as letter-size paper to confirm that the printer handled both.

Although the 8500 N isn't as impressive for a tabloid-size printer as the 4500 DN is for a letter-size printer, it's still worth considering. Although its speed is disappointing, the 8500 N is still one of the few color laser

printers yet announced that can handle tabloid-size paper at all, and it's the only one at this writing that offers duplexing at tabloid size.

Lexmark Optra Color 1200n

Lexmark's Optra Color 1200n (\$6,950 street) is the only printer in this roundup that uses LEDs rather than lasers to draw images. What's more, it offers four sets of LEDs—one for each color toner—which means that the unit can lay down all four colors in pass, yielding the same 12-ppm engine speed for both monochrome and color. Unfortunately, although our tests show that the 1200n has an edge in performance, its color output quality can't match the other three printers reviewed here.

The base model 1200 comes with 32MB of RAM. The 1200n, as tested, comes with 64MB and a Fast Ethernet connector. For

this roundup, Lexmark also provided its color scanner option (\$2,000 street) complete with the OptraImage unit that connects between the scanner and printer to let you use the combination as a color copier.

Setting up the 1200n is straightforward but time con-

suming. You have to put each of the four toner and developer units together before inserting the combined units into the printer. Installing the driver is standard fare, with the setup program giving you the choice of installing the PostScript 2 driver, the PCL 6 driver, or both. We used the Post-

Script driver on our tests. For network printer management, the 1200n uses Lexmark's MarkVision software, which you'll find described with high praise

in our most recent network printer roundup.

On most performance tests, the 1200n's print speed stood up well to the competition: The unit scored about 9.7 ppm on the 12-page Word document and turned out the single-page Word document in about 20 seconds. On the color tests, the 1200n printed the two pages of graphs from Excel in about 30 seconds and the test photo from Photoshop in under 10 minutes. Results on the PowerPoint test varied significantly on different runs; the best speed was 52 seconds.

Alas, output quality is a problem with this printer. At 600-dpi resolution enhanced to what Lexmark calls "1200 Image Quality," the output simply didn't measure up to the other printers here. Lines and edges in text and graphics are suitably crisp, but the quality suffers from obvious dithering in graphics output mode, visible streaking, and severe misregistration. The misregistration is greater than for either of the HP printers, which makes the problem far more obvious when it shows up as well as occurring in a greater percentage of output.

The copier feature is notable both for its ease of use and the color matching between input and output. Ultimately, however, flawed output makes recommending the 1200n without reservation difficult. **PC**

Street price: \$6,950
Lexmark International
Inc., Lexington, KY;
800-539-6276;
www.lexmark.com
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On Deck: The Tektronix Phaser 840 Plus

The Tektronix Phaser 840 Plus (\$3,200, street) is the company's newest solid ink printer, which should be available by the end of December. This 1,200-dpi printer is rated at 10 ppm for both color and monochrome and is the first Tektronix printer to use blocks of resin for ink rather than blocks of wax.

Resin ink offers a slightly less obvious raised look and feel on the page compared with wax. The company claims that the pages are less likely to jam copiers than pages printed on solid wax machines. The pages still tend to stick on a copier's glass platen, however, rather than sliding across it easily.

For this story, we looked at a pre-production version of the Phaser 840 Plus. The printer output crisp text and lines

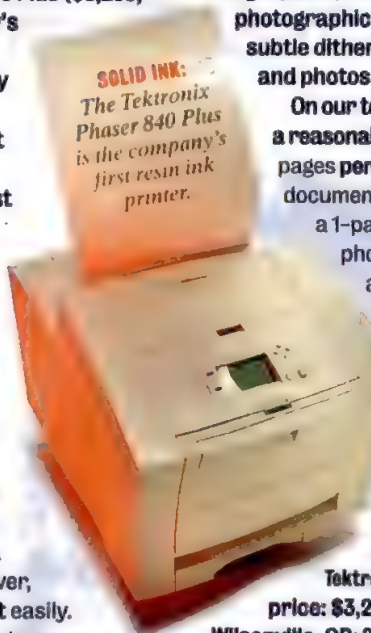
in graphics, brilliant colors, and near photographic quality photos, despite subtle dithering patterns in graphics and photos.

On our tests, the printer managed a reasonable speed as well, at 5.6 pages per minute for a 12-page Word document and about 14 seconds for a 1-page document. A full-page photo from Photoshop took about 20 minutes to print in highest quality mode.

Keep in mind, however, that these tests used a preproduction unit, so output quality and speed will likely change. We look forward to seeing the final product.—MDS

Tektronix Phaser 840 Plus. Street price: \$3,200. Tektronix Inc.,

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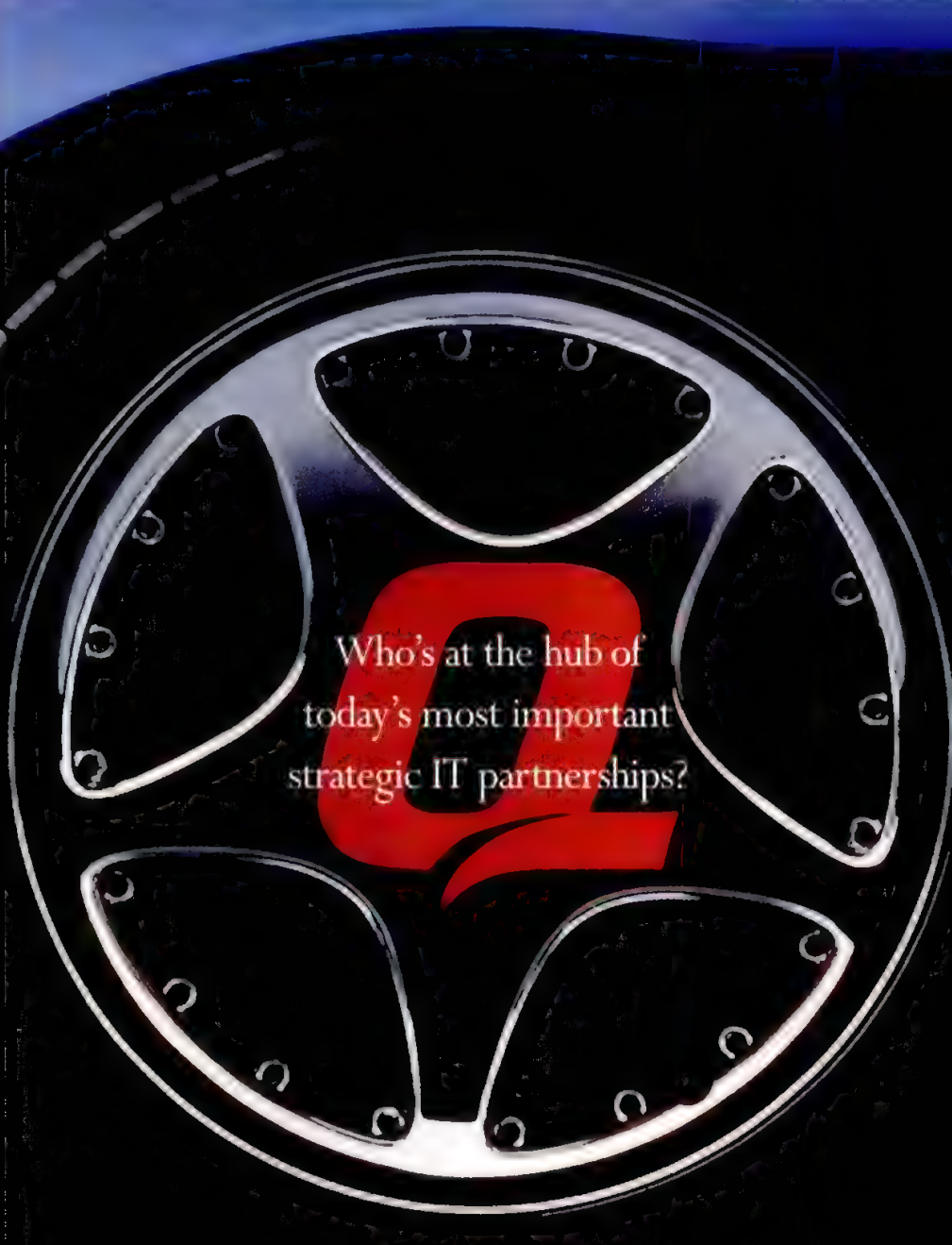
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Microsoft Unveils IE 5

The first public beta of Internet Explorer 5 is ready and waiting for download.

By Jim Lynch

Microsoft's Internet Explorer 5 builds on many of the earlier features found in IE 4.x. Among the changes in this version are enhancements to managing Favorites, a refined search mechanism, interface and functionality enhancements to Outlook Express, and the ability to save entire Web pages—graphics as well as HTML code—to a hard disk.

We found IE 5's installation straightforward, requiring only one reboot to update the system, after which we loaded IE and Outlook Express without any problems. Microsoft has added some additional setup options: We could decide whether we wanted Web pages, media content, and mail addresses associated with IE. This makes IE 5 less intrusive in your Windows environment. The irony here is that Netscape appears to have moved in the opposite direction. (For a review of Netscape Communicator 4.5, see page 60.)

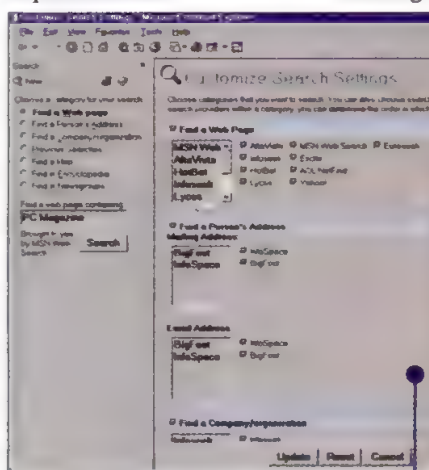
NEW FEATURES

One of IE 5's more basic but useful features is the ability to save complete Web pages locally by choosing "Save As" under the File menu. IE also lets you save pages as HTML only, Web archives, or as text files.

Another nifty new feature is the ability to dismiss that annoying pop-up message telling you "Your Download is Complete!" One thing that's still missing is the ability to see file sizes during downloads. Here, Communicator still stands above IE 5.

IE 5 includes enhanced bookmark management features. Microsoft has added two buttons, Add and Organize, to the top of the bookmark display box, making bookmarking a site or managing your bookmarks easier.

Adding new bookmarks to our Favorites list was simple. We just clicked on the Add button and then specified the folder where we wanted to put the bookmark. When it came time to organize them, the management window let us create a new folder, delete or rename bookmarks, or move them into a specific folder.



LOOK IT UP: IE 5 makes it easy to search for an e-mail address, company, or Web page using multiple search engines.

Internet Explorer can now also export or import Favorites as well as cookies. We tested this by exporting our list of Favorites to our Netscape directory. When we performed our export, IE 5 targeted the Netscape directory, making exporting our bookmarks easier.

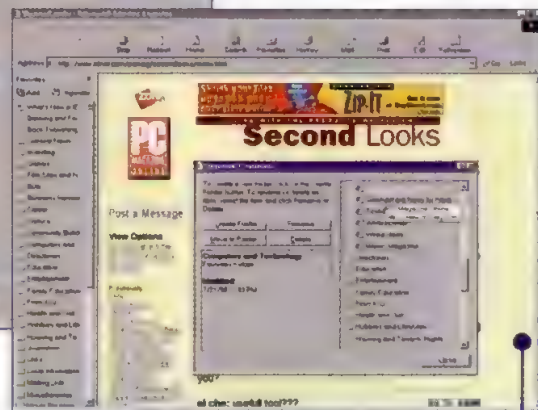
When adding a page to your Favorites list, you can now customize it for off-line viewing by checking the "Make Available Offline" box. This tells IE to download the page to your hard disk for local viewing. This is different from saving a page yourself locally, since IE does that automatically, placing the page in cache rather than in a folder of your choice. (The page will be deleted when your cache is emptied, unless you

use the Save As feature.)

You can also choose to download all the links on a page. This is a good feature, but we wish that we could have specified how many levels below the initial page we wanted to download. We were also able to specify a download schedule (daily, weekly, or monthly).

SEEK AND YE SHALL FIND

Microsoft has done a great job of improving IE 5's search capabilities and customizability. Clicking on the search icon



brings up a window that lets you search for a Web page, address, e-mail, company, or map, as well as review or repeat previous searches. You can also search newsgroups and Microsoft's own Encarta site. Though the default search engine is Microsoft's Web Search, you also can use different search engines.

Switching between search engines during a search is as easy as clicking a drop-down menu on the search window. We didn't need to retype our keyword: We simply picked another search engine and our search was repeated at the new site.

We found the advanced search to be very useful in isolating various media types. We were able to specify exactly the kind of media we were looking

for, including graphics, VRML, text, images, sound, and more.

AN OFF-LINE READER IS BORN

Internet Explorer's e-mail and news client has also gotten a makeover. Outlook Express has a slightly different interface and some additional features. Now you can view your contacts in a window along with your e-mail and newsgroup messages.

Microsoft has beefed up OE's off-line capabilities. It's now possible to download IMAP folders and News messages for off-line viewing, and you can reply off-line and then have your tasks completed the next time you go online.

Like its big brother, Outlook

ORGANIZE: You can delete, move, rename, or create folders with IE 5's Favorites management features.

98, OE can filter e-mail and newsgroup messages to help avoid junk mail. OE also lets you watch particular newsgroup threads or ignore ones that don't interest you.

It's too early to say how IE stacks up against Communicator 5.0, but what's clear is that Microsoft has raised the bar somewhat with this release. Internet Explorer 5 is definitely worth a download regardless of which browser you're currently using. **Microsoft Internet Explorer 5 (beta).** Price: Free. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com; 422 at www.pcmag.com/infolink.



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1. Power users have long known that Micron systems are among the absolute best in the industry. The editors of *PC World Magazine* just ranked Micron's Millennium desktop line as the #1 Power Desktop, #1 Home Desktop & #1 Consumer Desktop while *CNET* just named the Micron GoBook the #1 UltraPortable on the market today.

#1 RANKING FOR CUSTOMER SATISFACTION

2. Micron's customers are really satisfied — just ask them. In fact, the influential readers of industry bible *PCWeek* ranked Micron desktops #1 in total customer satisfaction.¹² And *Home PC* readers voted Micron #1 in providing the industry's best service and support.

PLEASE GO TO PAGE



"Micron's support policies are first-rate, with a three-year parts and one-year labor warranty and 24-hour toll-free phone support seven days a week."

- *PC World*, "Best Buy," August '98

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Defense Contractor



Micron Systems:
Over 100,000 deployed Micron desktops, notebooks & servers

Favorite Feature:
Price/power ratio

Purpose:
Help maintain US security and freedom

For The Whole Story: www.micronpc.com

Tim Willits
Lead Map Designer, *Id Software*
Creators of *Quake* & *Quake II*



Micron Systems:
Micron Millennium 400 desktops

Favorite Feature:
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Purpose:
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Just named #1 450MHz desktop by the editors of *CNET* and #1 Power Desktop by the editors of *PC World Magazine* (Millennia 400 DVD - October '98, Millennia® MAX 450 - *PC World* Best Buy November '98), Micron's Millennium desktop product line continues a long tradition of industry-leading, award-winning performance. Perhaps that's why some of the most prominent power users around rely on Micron. No matter how strenuous your demands, no matter how colossal the task, we invite you to put a Millennium desktop to the test. You'll be hard-pressed to find a Pentium® II processor based system as powerful and affordable as the Micron™ Millennium. And Micron's revolutionary new MPower™ purchase program makes Millennium ownership even easier, offering qualified users no interest⁰⁰ or payments for six months as well as PowerXchange™ trade-in options on your current Pentium processor class PC towards a new Millennium desktop.



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PAYING ISN'T FUN - BLOW IT OFF FOR 6 MONTHS

3. Micron's MPower™ program provides a myriad of flexible financing options including no-interest, no-payments for six months to qualified consumers as well as low monthly payment options on both consumer and business leases. No matter which award-winning system you choose, Micron makes PC ownership a breeze.

TRADE IN YOUR CURRENT PENTIUM™ PROCESSOR-CLASS PC

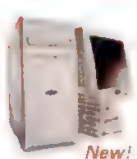
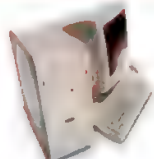
4. Only Micron offers you the option to trade in and trade up today. Trade in your current Pentium processor-class computer system(s) from leading manufacturers and we'll give you wholesale rebates with the purchase of new Micron systems. We'll even send you boxes to package up your old PCs.

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Model Name	Millennia C333	Millennia 350	Millennia 450	Millennia 450 MAX	Millennia 450 MAX
Processor	Intel® Celeron™ processor 333MHz	Intel Pentium® II processor 350MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz
Cache	512KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.4GB Ultra ATA hard drive*	6.4GB Ultra ATA hard drive*	6.4GB Ultra ATA hard drive*	13.4GB 7200 RPM Ultra ATA hard drive*	13.4GB 7200 RPM Ultra ATA hard drive*
Monitor	15" Micron 500ix monitor (13.8" display)	17" Micron 700ix monitor (15.9" display)	17" Micron 700ix monitor (15.9" display)	17" Micron 700ix monitor (15.9" display)	19" Micron 900ix monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	4.8X DVD 32X ROM drive
Modem	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**	3Com/U.S. Robotics 56K WinModem**
Graphics	nVidia Riva 128, 4MB SDRAM 3D ACP graphics	nVidia Riva 128, 4MB SDRAM 3D ACP graphics	nVidia Riva 128, 8MB SDRAM 3D ACP graphics	nVidia Riva 128, 8MB SDRAM 3D ACP graphics	Diamond Viper 200 nVidia Riva 128, 8MB graphics
Sound System	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound
Warranty	3-year/3-year Micron Power™ limited warranty	3-year/3-year Micron Power limited warranty	3-year/3-year Micron Power limited warranty	3-year/3-year Micron Power limited warranty	3-year/3-year Micron Power limited warranty
Software Included	Microsoft® Windows® 98 Microsoft Home Essentials Microsoft Power Pak Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus
Also Includes:	New MicroTower™ case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse™ 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New MicroTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Advent AV009 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	Micron MiniTower case Norelco PW1000 flat panel speakers w/subwoofer 100MB Imago Zip Drive 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive

Price	\$1,249	\$1,499	\$1,699	\$2,499	\$2,899
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Upgrade to:	Upgrade to: 64MB SDRAM memory 6.4GB Ultra ATA hard drive 17" Micron 700ix monitor (15.9" display) 100MB Imago Zip drive	Upgrade to: 128MB SDRAM memory 10GB Ultra ATA hard drive 17" Micron Trinitron 700ix monitor (16" display) 100MB Imago Zip drive	Upgrade to: 128MB SDRAM memory 13.4GB Ultra ATA hard drive 19" Micron 900ix monitor (18" display) 4.8X DVD 32X ROM drive	Upgrade to: 200MB Imago Zip drive Norelco PW1000 flat panel speakers w/subwoofer 19" Micron Trinitron monitor (18" display)	Upgrade to: 256MB 100MHz SDRAM Microsoft Natural Keyboard Elite

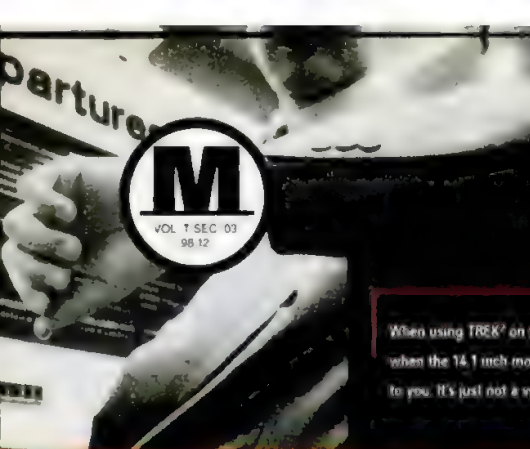
Price	\$1,545	\$1,932	\$2,232	\$2,866	\$3,214
	\$54/mo. TechRefresh Bus. Lease, 36 mos.**	\$68/mo. TechRefresh Bus. Lease, 36 mos.**	\$78/mo. TechRefresh Bus. Lease, 36 mos.**	\$100/mo. TechRefresh Bus. Lease, 36 mos.**	\$112/mo. TechRefresh Bus. Lease, 36 mos.**
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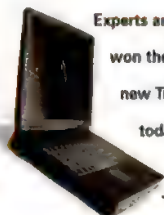
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Model Name

TREK² 233

TREK² 233

TREK² 266

New!
TREK² 300

Processor	Intel® Pentium® II processor 233MHz	Intel Pentium II processor 233MHz	Intel Pentium II processor 266MHz	Intel Pentium II processor 300MHz
Cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache
RAM	32MB EDO DRAM	64MB SDRAM	64MB SDRAM	64MB SDRAM
Hard Drive	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*
Monitor	12.1" SVGA TFT display	13.3" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
Extra Storage	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)
DVD/CD-ROM	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	DVD-ROM drive (dedicated bay)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
Sound System	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft® Windows® 98 System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus
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If you're looking for complete network solutions, or simply need to upgrade your current network, consider Micron™ ClientPro® managed PCs and Micron NetFRAME® servers. Network-ready right out of the box, packing the power of the Intel® Pentium® II processor 450MHz, and built on industry standards, the ClientPro effortlessly puts more manageable power in your office. And if you're looking for a reliable and expandable server, it would be tough to beat Micron's NetFRAME servers running with the powerful new Intel Pentium II Xeon™ processor.

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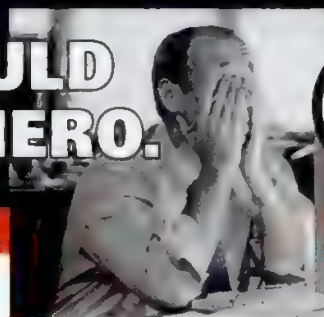
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NetFRAME 3100
Nov '98

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you're starting to scratch the surface. Let's face it, when you're crawling around under someone's desk in a jungle of twisted cables because they want to see the dancing baby and you're the only one in the office that understands that "hot-swappable hard-drives" aren't something dirty, the last thing you need is a server that's anything but flawless.



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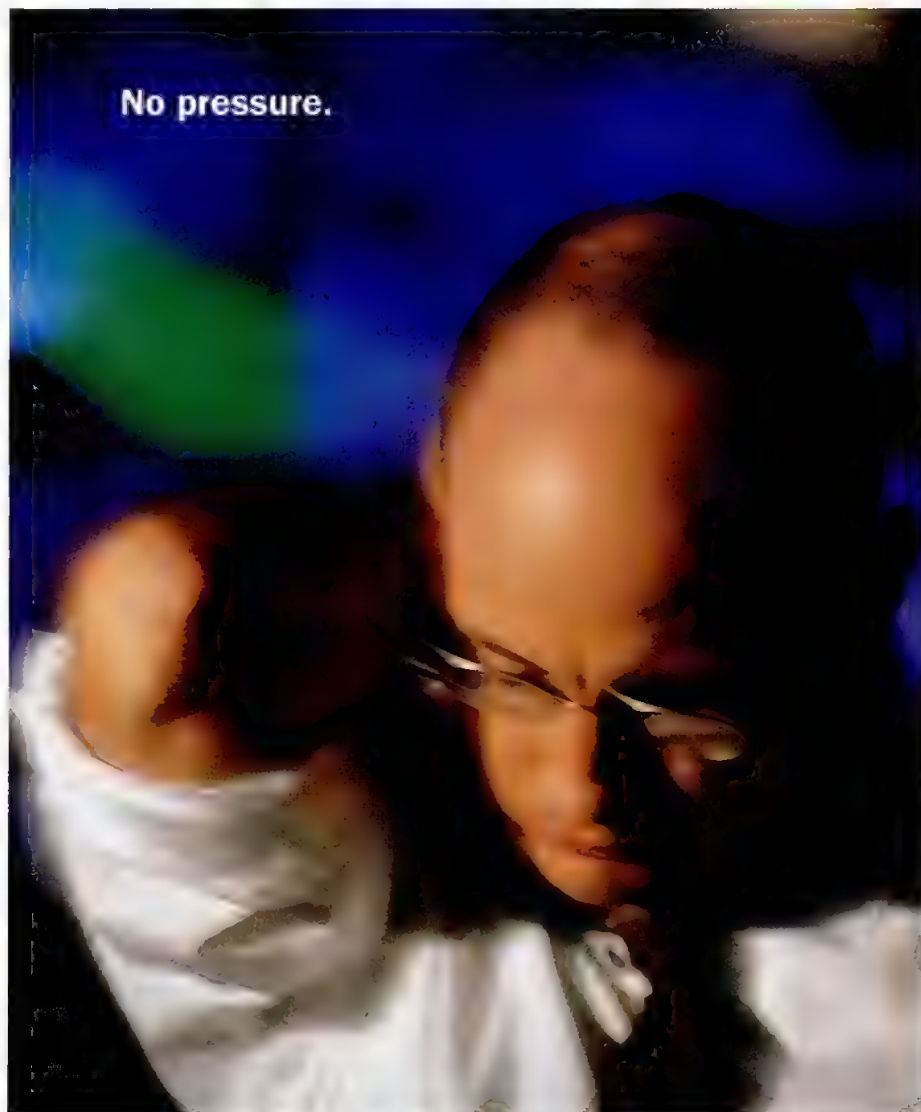


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Take Dictation on the Go

NaturallySpeaking Mobile merges mobile recordings with desktop speech recognition.

By Bruce Brown

Dragon Systems extends continuous-speech recognition technology to mobile users with Dragon NaturallySpeaking Mobile (\$250 street). This version includes a hand-held recorder, a voice file transfer program, and Dragon NaturallySpeaking Preferred, an Editors' Choice-winning speech recognition software application.

The Dragon NaturallyMobile Recorder is lightweight (3.8 ounces) with two triple-A batteries and measures 4.8- by 2.3- by 1-inches (HWD). The palm-size recorder displays messages on its three-line by ten-character backlit LCD, and ten well-positioned buttons facilitate scrolling and organizing recordings.

You can use the built-in mi-

crophone, connect to an external microphone, or use an included headset. The recorder's speaker plays back clearly at normal, fast, or slow speeds.

The recorder's 40-minute memory capacity is expandable. Inserting standard 2MB, 4MB, or 8MB SmartMedia or SSFDC cards (not included) expands recording capacity by

SMALL TALK: The palm-size NaturallyMobile Recorder.

20, 40, and 81 minutes respectively. A supplied serial cable connects the voice recorder to your PC.

It takes about 20 minutes to record the training text to set up

the program to recognize your voice. Then it takes about an hour for the recognizer to adapt to your recorded speech for future transcription.

Once you have made a voice recording, uploading it to your computer requires only a few steps: Connect the recorder to your PC, open Voice it Link, and upload the recording in WAV file format. Voice it Link stores recordings in folders until transcription.

Transcribed text is automatically displayed after recognition for editing and formatting. In testing with several passages and documents, recognition was very good but not perfect. Dragon NaturallySpeaking Preferred's correction and vocabulary builder features work with the recorded files for im-

proved recognition accuracy.

As the program adds your vocabulary and speech patterns to its data files, accuracy increases. Switching users or user modes for voice command editing is possible, but by doing so you'll lose access to the recorded voice file. Therefore, editing via keyboard and mouse is recommended.

With Dragon NaturallySpeaking Mobile you can record information anywhere, upload recordings to your computer, and have them automatically transcribed. Dragon NaturallySpeaking Mobile is a blue-ribbon bundle providing both desktop and mobile use from the get-go.

Dragon NaturallySpeaking Mobile. Street price: \$250. Requires: 48MB RAM, 120MB hard disk space, Microsoft Windows 95, 98, or NT 4.0 or later. Dragon Systems Inc., Newton, MA; 800-825-5897, 617-965-5200; www.dragonsys.com; 416 at www.pcmag.com/infolink.



Get Your Info on Track

Enfish Tracker Pro goes beyond standard file searches by integrating e-mail and Web pages.

By Barry Simon

The hallmark of the Information Age is having so much information that you're overwhelmed. For many of us, it's difficult to find the information we know we've seen but can't recall where. Traditional file-indexing programs are limited because more often than not information is stored as saved e-mail or on some Web page we've seen.

Enfish Tracker Pro (\$80 street) changes this by indexing your files, e-mail, and selected Web pages, and then giving you a flexible set of tools to manage the indexed data. This is the kind of breakthrough product that could change the way you interact with the information on your computer.

During installation (and later on demand), the program ana-

lyzes your data and sets up some initial trackers (saved searches). It was uncanny how the program set up trackers for e-mail correspondents and projects automatically.

Enfish has licensed the full set of Inso viewers (the ones used in QuickView Plus) for use inside the Enfish window and for tracking. That means Tracker Pro can index the text inside virtually any spreadsheet program or word processing document.

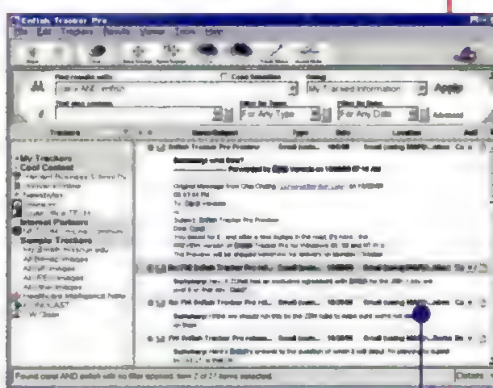
Tracker Pro will also search any e-mail in most popular e-mail programs and even searches inside e-mail attachments. It can access and index contact information inside ACT!, Goldmine, or Outlook. Tracker Pro also indexes the content of Web pages.

The index is frequently updated by a background agent. Because of the magic of MAPI,

when you move a message between e-mail folders, Tracker Pro can open it even though the message showed the wrong directory (at first). But a disk file doesn't work that way; you cannot access a renamed or moved file from Tracker Pro until it's updated.

You can perform Boolean searches on one or more words; the program will search for phrases but not nearby words. You can filter based on file type, mail sender or recipient, date, or location. Filters can be both inclusive and exclusive.

By carefully picking the search words, a tracker can encompass all the information associated with a project. The shift in paradigm from searches to projects is helped by the inclusion of cross references between trackers in the listings of items tracked.



FIND FILE: The results of a search are displayed in the main panel of Enfish Tracker Pro.

Anyone who juggles lots of information, especially lots of e-mail will want Enfish Tracker Pro.

Enfish Tracker Pro. Street price: \$80. Requires: 16MB RAM, 50MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Enfish Technology Inc., Pasadena, CA; 888-222-3634; www.enfish.com; 417 at www.pcmag.com/infolink.

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Web Sites, Office Style

NetStudio lets you create quick and easy Web sites within a Microsoft Office-like environment.

By Luisa Simone

If you're looking for fool-proof Web graphics, check out NetStudio 1.0. This \$100 (street) program helps business users produce great-looking Web sites by providing ready-to-use templates and preformatted styles, all wrapped up in an Microsoft Office-style interface.

Over 100 templates for common design elements (such as banners, buttons, JavaScript rollovers, navigation bars, and pictures) allow you to format your images with drag-and-drop ease. You can further modify objects with effects such as coloriz-

ing, drop shadows, embossing, engraving, and transparency. Simple slider bars and option buttons let you customize each effect—albeit within strict limits.

Because NetStudio identifies each internally created object by function, it can correctly apply a set of related styles to all of the graphic objects in a Web page with a single mouse click. Tabbed access to the style components provides a bit more freedom by letting you mix and match color schemes, special effects, and type treatments.

NetStudio is designed to be a picture processor rather than a

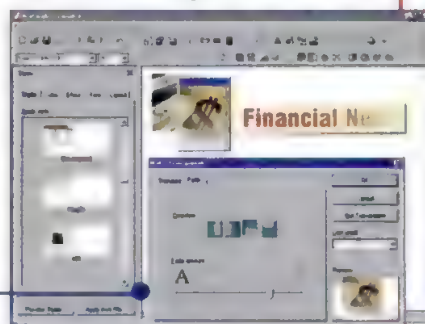
paint or drawing program, so it won't let you create custom shapes. This means a button you design from scratch must always be a rectangle and a bullet must always be a circle. With the exception of basic filters (like brightness and contrast) NetStudio offers no image-editing tools. Even

SIMPLE SITE: NetStudio's preformatted styles and ready-made templates let you create sophisticated effects.

the layout tools are sparse; essential functions such as alignment and grouping are noticeably absent.

Although NetStudio saves standard Web-compatible graphics formats (GIF, JPEG,

and PNG), the program fails to provide options for color reduction, compression levels, or image slicing. As a result, NetStudio's output files are often



larger than those produced by true Web-optimization programs like Adobe ImageReady or Macromedia Fireworks.

NetStudio can open HTML pages—letting you format and preview your graphics in place. And because saving the HTML file from NetStudio automatically inserts your graphics, you don't have to mess with code. The exception is a JavaScript rollover, which you must still manually cut and paste into an HTML file.

NetStudio integrates well with a number of HTML editors, letting you edit graphics directly in a FrontPage document, for example. But it also relies on those programs to handle essential Web image functions—such as assigning URLs and generating image maps.

Compared with its chief competitor, Adobe ImageStyler, NetStudio earns points for ease of use, though its limited layout and formatting options put a cap on your creativity. But if you're a business user with little interest in expanding your artistic skills, NetStudio provides instant art direction for your Web site.

NetStudio 1.0. Street price: \$100. Requires: 16MB RAM (32MB for Windows NT), 30MB hard disk space, Microsoft Windows 95, 98, or NT 4.0 or later. NetStudio Corp., Berkeley, CA; 510-644-9700, 800-672-9559; www.netstudio.com; 414 at www.pcmag.com/infolink.

Ink Jet Suited for SOHO

The new Epson Stylus Color 740 ink jet printer boasts 6 picoliter ink drops, plus USB connectivity.

By Bruce Brown

USB printing is here, and it works just fine. The new four-color Epson Stylus Color 740 (\$280 street) has standard parallel and Macintosh serial ports, but the most notable interface is its USB port. When connected to a PC via a USB cable (not included), the printer installs quickly and easily.

The 740 uses the most advanced version of Epson's Micro Piezo technology, with variable-size ink droplets as small as six picoliters. Targeted for SOHO users, the 740 is a step up in performance from the Epson Stylus Color 640 and comes with an attractive price.

Equipped with a 144-nozzle monochrome printing head and a 48-nozzle by three-color (CMY) head, the 740 can print at 1,440- by 720-dpi, 720- by 720-dpi, 360- by 360-dpi, and 180- by 180-dpi resolutions. The 740 has a rated top printing speed of ap-

proximately 6 ppm for black text and 5 ppm for mixed text and graphics. Photo printing is rated at 1 minute, 19 seconds for a 4- by 6-inch print. In testing with the included Adobe Pho-



PRINT QUALITY: Expect fast, fine-quality USB printing with the Epson Stylus Color 740.

toDeluxe 2.0 in highest quality mode on glossy photo paper, a 4- by 6-inch photo print took 4 minutes, 16 seconds to print.

The 740's print quality is impressive. Text and mixed text and color graphics look very good. Photo prints rival those of the photo-centric Epson Stylus Photo EX printer in quality, boasting good color and fine detail. Com-

pared with the Stylus EX, the 740 is significantly quieter during printing. The 740 was quicker; the Stylus EX took 6 minutes and 14 seconds to print the same image.

The 740 comes with one black ink and one color cartridge. Replacements for each cost \$25 (street). With 15 percent coverage, the color cartridges are rated for 300 pages, or 8.5 cents per page. The black cartridge is rated

to print 634 pages with 5 percent black coverage for a per-page cost of 4 cents.

The Epson Stylus Color 740 is a fine choice for general home or small office printing, especially if you use your parallel port for other purposes and can take advantage of its USB connectivity.

Epson Stylus Color 740. Street price: \$280. Requires: 16MB RAM, 50MB hard disk space, Microsoft Windows 3.1 or higher or NT 4.0. Epson America Inc., Torrance, CA; 800-463-7766, 310-782-0770; www.epson.com; 415 at www.pcmag.com/infolink.

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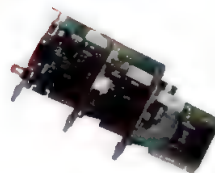
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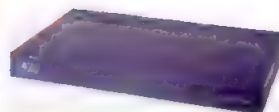
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Unlimited 3-D

Caligari's feature-filled trueSpace4 lets you create more realistic 3-D modeling and animations.

By Jan Ozer

Caligari's trueSpace4 (\$595 direct) is an extraordinarily feature-rich 3-D creation program, especially for modeling and human-form animations. A no-brainer upgrade (\$299), trueSpace4 is also a great first program for those new to 3-D creation.

The trueSpace4 interface still consists of one screen where you create and animate objects and lay out your scene. You can easily toggle between perspective, top, front, and left views in the main window, or open up smaller windows containing additional views. You can also view the scene from any light source or from any object or camera, assisting precise asset placement.

New in trueSpace4 are 3-D controls for navigation, object properties, point-editing, and viewing, as well as global properties. The controls, which replace nested menu commands, are small but expandable 3-D objects that appear in space, assisted by function descriptions on the status bar. Though operation isn't perfect (widgets occasionally disappear), they work extremely well, enabling fast and precise object sizing and placement.

MODEL MODELER

Caligari's trueSpace4 offers an unparalleled range of modeling tools, starting with NURBS, which convert design primitives such as cubes and spheres into editable shapes useful for organic objects like faces. In addition, Metaballs combine cubes, cylinders, spheres, and other primitives under one smooth skin, allow-

ing the fast creation of complex objects like fingers.

Finally, PlastiForm converts object surfaces into particle mesh that can be "engraved" with a cylinder or ball, like sculpting cake icing with a spoon. Though you can't convert NURBS into Metaballs, you can convert Metaballs into NURBS and then edit the result with the PlastiForm tool. All three tools have significant learning curves, but together they make up the most flexible suite of object creation tools in a sub-\$1,000 3-D program.

TrueSpace4 also offers the normal set of design primitives with Boolean operation, polygonal and spline-based draw-

tion and object placement.

The texture capabilities in trueSpace4 are on a par with those of competitive products, though slightly less intuitive. Highlights include 3-D paint support and an intuitive system for selecting and previewing shader attributes.

LIGHTS, CAMERA, ANIMATION!

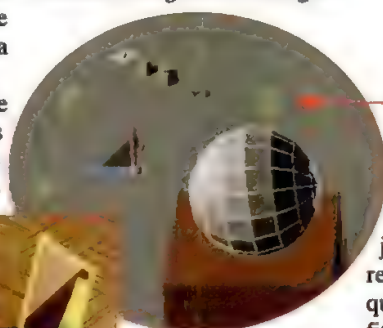
TrueSpace4 offers six lighting types, including spot, projector, and sky and array lights, used primarily for radiosity simulations. The two most significant interface gaps are the lack of directional widgets for the lights

cles, which brings realism to human forms and lets you insert a skeleton into inanimate objects to bend, twist, and animate them. Also new are function curves in the keyframe editor and scripting capabilities.

MAKING THE SCENE

New volumetric lights enable effects such as depth cue shading, fog, and snow. Fog and snow can't be animated, however, and control over placement is limited. Also new in trueSpace4 is a radiosity renderer that simu-

GET AROUND: trueSpace4 features new navigational widgets—the red, blue, and green figure to the left of the sphere.

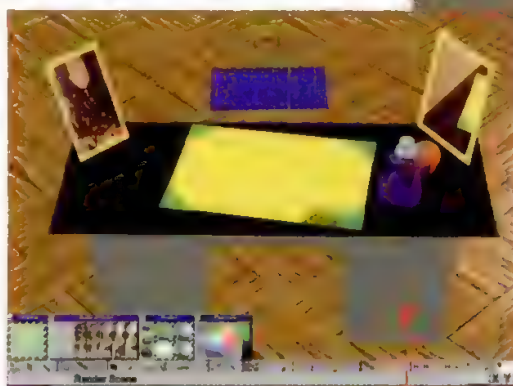


lates the effects of direct and indirect light sources. Radiosity added substantial realism Caligari's sample projects, but our test projects (with relatively simple lighting requirements) showed little benefit over similar scenes rendered by other programs.

Rendering times were fast, however, and the engine licensed from Lightworks produced realistic objects and textures with minimal anti-aliasing, even when using adaptive anti-aliasing. Other noteworthy options include field rendering, required for film output, and the ability to produce VRML 2.0 files.

At the risk of sounding overly dramatic, you don't review a 3-D program as much as survive it. As a group, these programs are extremely feature-rich and idiosyncratic, with steep learning curves. Once you make the climb with trueSpace4, however, you'll be rewarded with a program that can go as far as your imagination can take you.

trueSpace4. Direct price: \$595. Requires: 32MB RAM, 20MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Caligari Corp., Mountain View, CA; 800-351-7620; www.caligari.com; 407 at www.pcmag.com/infolink.



WORKPLACE: You create all models and animations in trueSpace4's full-screen interface, with all controls accessed from nested menu icons on the bottom.

and menu-based sizing controls, so you have to point and size them directly, which is clumsy when a light is pointed away from the camera. Camera placement was also hindered by the lack of directional widgets.

The program is a flexible keyframe editor with separate controls for rotation, movement, and scaling of all objects, and the usual tension, bias, and continuity controls over keyframe values. You can animate all object-creation activities, including NURBS, Metaballs, and PlastiForm, as well as texture changes and light and camera movement, and you can create and edit an animation path.

Like previous versions, trueSpace4 supports inverse kinematics, which is useful for human and robot animations. The new version adds bones with deformable skin and mus-

ing, and sweep, lathe, and extrusion, as well as extremely capable object deformation tools. Also noteworthy is a dimensional tool for technical illustrators and a surface deformation tool for landscapes.

We had minor problems with collision detection, but Caligari claims a fix should be available on its Web site by the time you read this. TrueSpace also offers a magnet feature that links objects, letting you slide, roll, or spin one object against another, useful for both anima-

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Netscape Moves in on Microsoft

Expect smarter browsing and tighter Windows integration with Netscape Communicator 4.5 and its portal site, Netcenter.

By Jim Lynch

The Web browser wars are alive and well these days, as Netscape has fired another salvo with the release of Version 4.5 of Communicator. Make no mistake: Netscape has its guns trained on terrain usually controlled by Microsoft. The suite's new features include a revamped Messenger, Smart Browsing, What's Related, Smart Updates, and tighter integration with Windows.

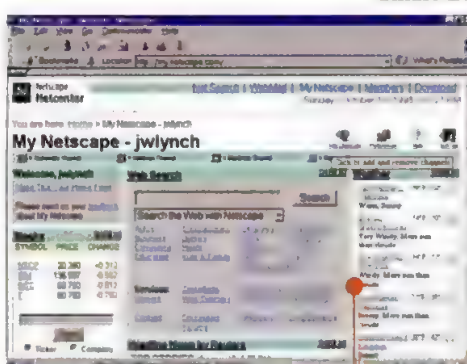
WORKING WITH WINDOWS

Netscape has made an aggressive attempt to integrate Communicator with Windows. During the installation process, we were asked if we wanted to have Communicator as our default browser and Netcenter as our default start

page and search engine. We accepted these choices and noticed that Netcenter became our default page in both Communicator and Internet Explorer.

Netcenter is similar to other portal offerings, such as My Excite and My Yahoo!, and includes services such as news feeds, weather, horoscopes, and stock quotes. During installation, Communicator also automatically added three buttons to the Windows 98 taskbar, letting us launch Communicator components with one click.

Each of these moves reflects Netscape's newfound aggressiveness in using cross-browser start-page synchronization to drive traffic to its portal and to



YOUR PAGE: Netcenter, the portal bundled with Communicator, offers personalized news, weather, horoscopes, and stock quotes.

give Internet Explorer some competition within the Windows interface. These moves by Netscape are bound to tweak a few noses in Redmond; Win-

dows is no longer the sole domain of Internet Explorer.

BROWSE BETTER

Smart Browsing is another of the new features found in Communicator. Simply enter a keyword into the browser and Communicator will check Netcenter's database for a matching site; for instance, typing "World Series" will take you to Major League Baseball's official World Series Web site. If no matching site is found, a list of possible sites will be displayed. Smart Browsing is like having a search engine built directly into the browser.

Once we found a site, we had a chance to play with another Communicator feature called What's Related. Accessed via a

Join the Online Club

Online communities have been around since the dawn of the Internet. In those early days, they were mainly Usenet groups, e-mail lists, and IRC chat rooms. These days, however, online communities are undergoing a renaissance that is taking them in an unexpected direction. They're moving to user-managed communities, complete with publishing tools and calendar capabilities.

YAHOO! CLUBS

Yahoo! Clubs contains all of the basics users need to build their own communities, including chat, message boards, as well as a calendar feature. To set up our community, we needed to have a Yahoo! ID and a valid e-mail address.

During the setup process, we had the choice of making our club public (by listing it in the main directory) or private (by making it unlisted). We opted for exclusivity and kept our club private; only those we invited to join as members could access it.

After setting up the club, we were able to customize it by adding the URL for our logo. Unfortunately, we weren't able to upload the graphic; we were able only to link to it, making it necessary to have separate storage space for the graphic. But the logo that was displayed was distorted, since Yahoo! Clubs does not let you customize how the graphic will look.

As with traditional communities, moderation and management are necessary. Yahoo! Clubs offers a number of management tools. Administrators can delete problem members, ensuring that they never have the option of returning to the

club again. Administrators can also give other users the power to edit and manage the community. Community managers can also send e-mail to all club members, using the administrator's e-mail address as the return address.

Yahoo! Clubs come with standard message board and chat capabilities. The message boards are based on Yahoo!'s regular message boards, so they're easy to use. The chat room, based on the popular Yahoo! Chat interface, functions in a similar way. We were able to customize the text in our chat room, send private messages, and invite others to join our chat.

Yahoo! also offers a calendar feature, making setting up events in your community easy. Members can access the calendar whenever they wish and can view the calendar by day, week, month, or year.

Yahoo! Clubs. Price: Free. Yahoo! Inc., Santa Clara, CA; 408-731-3300; clubs.yahoo.com; 409 at www.pcmag.com/infolink.

EXCITE COMMUNITIES

Yahoo! Isn't alone in rolling out club communities. Excite has aggressively entered this space as well. Although Excite's offering was in beta at the time of our evaluation, it still had thousands of user-generated communities up and running.

All we needed to set up our community was a valid Excite ID. We didn't have to wait for an e-mail confirmation as we did with Yahoo! After setting up our community, we customized it by uploading graphics to our photo album. Photo albums can be shared by members of the community and can include a

Intel Tech BUZZ

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Client Power for Enterprise Efficiency

In business, as in nature, the effect of small, evolutionary changes often cumulates into dramatic new possibilities. Such is the case with changes in the business computing environment.

Advances in Three Categories

Incremental advances are occurring in three major categories of PC software:

- The underlying infrastructure and operating systems services.
- Productivity applications users see and manipulate in the foreground.
- Background services that run automatically and without user intervention.

In the past few years, all three categories have become more complex, integrated and interconnected. Operating systems are more robust, with support for multitasking and helpful platform services. Applications operate as integrated suites, offering visual interfaces and collaboration technologies. Background services include agents and push technologies, and perform such tasks as virus scanning, and message and calendar synchronization.

Today, these trends are accelerating. Within the lifetime of today's PCs, operating systems will become even more advanced and feature rich. Productivity applications will become increasingly versatile and interrelated, making greater use of rich data such as speech and video. Automated background services, such as compression, encryption, system management and personal information agents, will offer even more intelligent services that react to key events and implement IT policy without user interaction.

The Intel® Pentium® II processor is the most powerful PC processor ever. It's the only processor that can handle the most demanding applications and services. It's the only processor that can handle the most demanding applications and services. It's the only processor that can handle the most demanding applications and services.

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Moving forward, each category alone will become more powerful, and all three will operate concurrently. This combination of concurrent applications and services is a natural evolution of business computing. It creates an environment where each user's high-performance PC simultaneously processes multiple foreground and background tasks. Not only does the user multitask among numerous applications, but the PC and the network are also



simultasking, engaged in background processes on the user's and IT infrastructure's behalf. The cumulative effect is to dramatically increase the performance demands on the client PC.

Benefits for End Users and IT

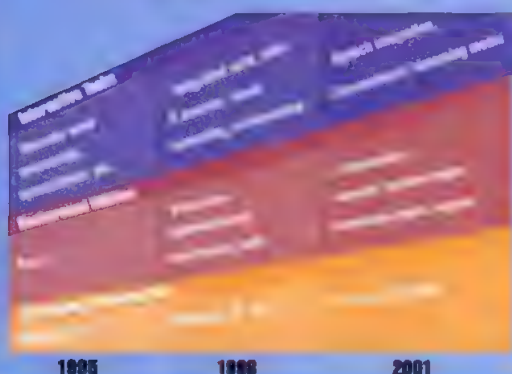
This emerging environment uses the power of the PC to make end users more productive and IT more effective. End users can automate many mundane, time-consuming tasks. For example, automatic agents and filters can sift the Web for information that will give users a competitive edge. Network efficiency, systems management and data security can all be enhanced with automated e-mail compression, message encryption and virus scanning.

Purchasing Implications

In deciding the performance needs of business client PCs, the crucial factor isn't the performance requirements of any single application. Rather, it's the cumulative effect of having the PC continuously and concurrently execute a growing number of increasingly sophisticated foreground and background tasks.

To take advantage of this rapidly emerging environment, businesses should choose powerful client PCs that can maintain responsiveness even when background processes are simultaneously at work with foreground applications. Desktop and mobile PCs based on high-performance Intel® Pentium® II processors provide an outstanding foundation for evolving capabilities today, and future Intel® processors will further enable these capabilities tomorrow.

The Evolution of Business Computing



Intel's Technology@Work Web site provides in-depth information to help IT professionals make more informed technology purchase decisions. For more information on thriving in this evolving computing environment, register at www.intel.com

button at the top of the browser. What's Related offers you a range of sites related to the one you're currently visiting.

We found this to be a real value-add when doing research; instead of having to do additional searches in a separate search engine, What's Related sometimes lead us to valuable sites.

MESSSENGER

Communicator's e-mail client, Messenger, has gotten a much-needed facelift. Netscape has made Messenger's e-mail interface much more customizable, as you can choose a one-, two-, or three-pane view of your e-mail. The return of the three-pane interface is a welcome change; we missed it in Version 3.0. With Messenger, you can also import mail from Eudora and Outlook mail clients.

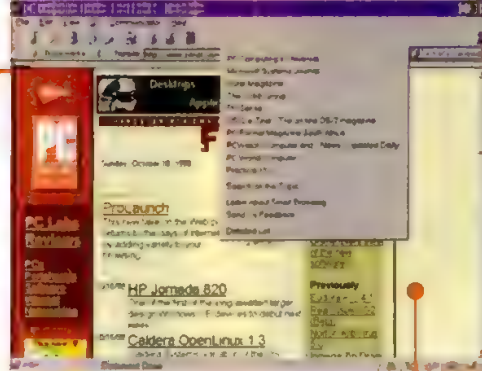
One feature that puts Messenger ahead of Outlook 98 is its address book searches. We easily

searched the Netcenter, InfoSpace, and VeriSign e-mail directories directly from the Messenger interface. We searched by e-mail address, name, and organization, and once we had results, we could scroll down to see whether the address we wanted was available in the results window. If it wasn't, we were able to click on a different directory to check for our address.

SMARTUPDATE

Communicator's new SmartUpdate makes keeping your browser updated a snap. Using SmartUpdate, Communicator handles all the details of an upgrade by downloading the file, logging changes, and placing the needed files in the proper directory.

SmartUpdate also speeds up an upgrade by letting Communi-



WHAT ELSE? With Communicator's new What's Related feature, you'll be able to find sites related to the one you happen to be visiting easily.

cator upgrade only the code that has been changed, thus saving the user the hassle of downloading the entire program all over again. Users can also easily remove previous SmartUpdate changes.

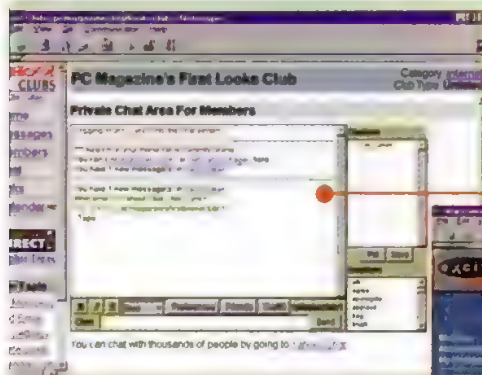
Netscape hasn't forgotten about the expanding market for hand-held devices. Communicator supports 3Com Palm devices with address book, mail, and calendar synchronization.

Despite all of the new features, Communicator does still have a few flaws. It lacks the full-screen feature of IE, and its bookmark

display is still somewhat primitive compared with Explorer's more elegant implementation.

Communicator and IE both lack a bookmark import/export feature, and neither has a way to synchronize bookmarks across browsers automatically. Although there are third-party utilities that do this, it makes more sense for the two leading browsers to have this built in, since many people use both.

But these are minor gripes. Communicator 4.5 is a great step forward for Netscape, with features that put it one step ahead of IE in a number of ways. It's worth checking out, regardless of which browser you're using. **Netscape Communicator 4.5.** List price: Free download. Netscape Communications Corp., Mountain View, CA; 650-937-2555; home.netscape.com; 408 at www.pcmag.com/infolink.



TALK: With Yahoo! Clubs you can create a private chat room for your community and use customizable text and fonts.

better integrated into the interface of our community; Excite's floated free in a separate window. Excite's message boards were roughly on a par with Yahoo!'s but don't allow you to enter a message number to hop around threads.

We were able to post announcements to our community but not send them over e-mail. This is definitely a feature that Excite should consider adding—otherwise community members have to stop by the community to catch announcements.

Excite does offer some useful community management tools. Administrators can choose whether or not to allow nonmembers access to any of the community areas and to allow members to add photo albums or delete their own posts on the community message board. Administrators can also decide whether or not the community is listed in the Excite Communities directory; they can elect to close the community to new members or allow members to join by approval only.

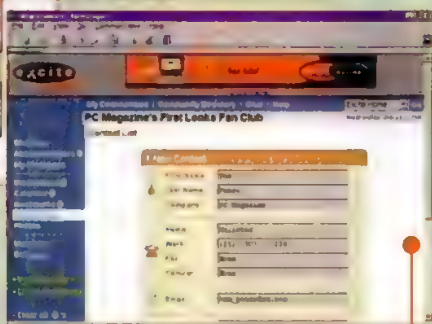
Excite offers at least one feature that Yahoo! Clubs doesn't: the ability to build contact lists for a community. Similar to those you might have in your own PIM, Excite's contact lists let administrators save contact names, phone numbers, e-mail addresses, business info, pager numbers, and more.

Excite Communities. Price: Free. Excite Inc., Redwood City, CA; 650-568-8000; www.excite.com; 410 at www.pcmag.com/infolink.

variety of graphics. Uploaded graphics are displayed at their respective sizes rather than being resized (as with Yahoo!). For community members, Excite provides storage space on its servers for graphics, which gives Excite a leg up on Yahoo!

Excite Communities also offers a calendar feature. Unlike Yahoo!'s calendar, members can view the Excite calendar only by day, month, or all events. This is a relatively minor problem, but additional calendar views would be useful.

Chat and message boards are also standard features with Excite Communities. We found Excite's chat room slightly less compelling than Yahoo!'s. We missed the ability to customize text colors and fonts, for example. The Yahoo! chat room was also



WEB PIM: Excite Communities lets you create a contact list for your community. You can save names, phone numbers, e-mail addresses, and more.

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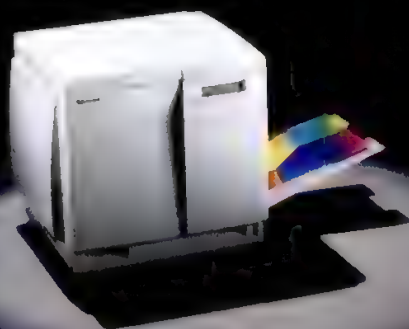
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Pocket Your E-Mail

Send and receive your e-mail from any phone with the new PocketMail service.

By Angela Hickman

Today, keeping in touch with your business contacts, friends, and family means always having access to your e-mail. A new service called PocketMail lets you do just that from any cordless, digital PBX, pay, or analog cell phone—without a cumbersome laptop or immobile desktop PC.

As a subscriber to the \$9.95-a-month PocketMail service, you dial a toll-free number and connect to the service using one of the PocketMail appliances—either Sharp's \$150 (street) Tel-Mail hand-held gadget (available in December) or JVC's \$100 (street) HC-E100 portable e-mail device, which is available in stores now. (Expect to see other PocketMail-enabled devices in the near future.)

Sending messages is a breeze: Compose an e-mail on your device's keyboard, save it to the OutBox, and then adjust the microphone arm on the back of the unit to fit snugly on the telephone's earpiece. The unit's speaker should cover the telephone's mouthpiece. Then call PocketMail's toll-free service and push a button on the top of the unit.

We found that transmitting short messages takes only a few seconds; longer messages of 500 characters can take upward of 25 seconds. When the device stops "talking" to the PocketMail network, simply hang up. To receive messages, you repeat the same procedure.

PocketMail offers a healthy dose of features. To bypass junk mail, for example, PocketMail has a spam filter, as well as a message title preview to save you time on the road. You can also block addresses and password-protect

your mail. If you have more than one e-mailbox but want to check only one while on the road, PocketMail lets you consolidate your mail by copying it from your other accounts to your PocketMail address.

PocketMail has limitations for users who get enormous amounts of mail. The PocketMail network supports messages only up to 4,000 characters and doesn't support attachments; you'll have to access those from your desktop computer (all mail resides on the PocketMail server for 30 days or

until you download it onto your desktop PC).

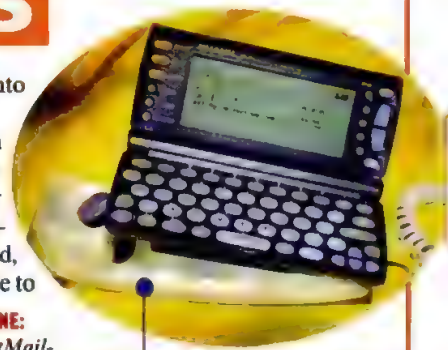
Background noise can also be a problem. We tried sending a message from our offices while a CD was playing loudly in the background, and PocketMail wasn't able to send our message until we lowered the volume.

ON THE PHONE:

The PocketMail-equipped JVC HC-E100.

In spite of these limitations, PocketMail is ideal for light-to-moderate e-mail users and is a useful companion device for people with heavy mobile communications needs, especially where coverage and performance for two-way pagers and cellular phones is limited. And

much for an online service or a full-functioning ISP for just e-mail, PocketMail is a must-have. **PocketMail Version 1.** Monthly price: \$9.95. PocketScience Inc., Santa Clara, CA; 800-390-5036, 925-371-5715; www.pocketmail.com; 406 at www.pcmag.com/infolink.

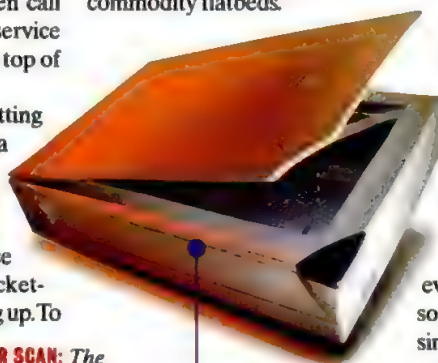


36-Bit Perfection

The Epson Perfection 636 is more versatile and captures better scans than commodity flatbeds.

By Daniel Grotta and Sally Wiener Grotta

With many color flatbed scanners selling for under \$50, why spend \$300 (street) for the Epson Perfection 636 scanner? Because it's faster, more versatile, and captures significantly better scans than cheap commodity flatbeds.



SUPER SCAN: The Perfection 636 produces scans of outstanding quality.

The Perfection 636 is a SCSI-2 device that can

accommodate up to 8.5- by 11.7-inch originals. It offers 36-bit color and an optical resolution up to 600-by-2,400 dpi. It also features a hardware zoom and batch scanning and can accommodate

an optional transparency adapter (\$99) or an automatic document feeder (\$199).

The Perfection 636 ships with a plug-and-play Adaptec SCSI board and cable. The scanner is remarkably easy to install and set up. Users may at first be confused by having to choose between the two included drivers, Epson Twain and LaserSoft. Both are Twain drivers, although LaserSoft may also be run as a standalone program.

The Twain driver gives users a wide selection of original image types, as well as an easy-to-set destination menu. The brand-name output devices are limited, however, primarily to a variety of Epson Stylus printers. Users can simply click Auto Adjustment to get better quality scans or can manually apply an extensive palette of prescan tools and options.

Designed primarily for photo scans, the LaserSoft features more complex yet robust descreening and color-correction tools. Besides a one-click auto-adjustment icon, it also has a photo mode for automatically

setting the scanner's active-area maximum resolution for scanning negatives and transparencies while avoiding overscanning.

The Perfection 636 is so fast that the bottleneck isn't the scan rate but the data transfer rate. This means the more RAM and the faster the CPU your PC has, the faster it works. On our test system (a 200-MHz Pentium with 128MB of RAM), we scanned a 4.5- by 6.45-inch color photograph at 200 ppi to produce a 3.28MB TIF file. With the Twain driver, the scan took an average of 14.1 seconds, and with LaserSoft, 18.1 seconds. Similar scans with USB and parallel scanners typically took between 35 and 65 seconds.

Our test scan's image quality was outstanding. Colors were accurate and intense but not oversaturated; details were captured in the shadows and highlights without clipping, and everything was crisp and sharp. Easy setup, speed, versatility—and above all—scan quality make the Epson Perfection 636 an excellent buy. **Epson Perfection 636.** Street price: \$300. Requires: 16MB RAM, Windows 95 or 98. Epson America Inc., Torrance, CA; 800-463-7766, 310-782-0770; www.epson.com; 411 at www.pcmag.com/infolink.



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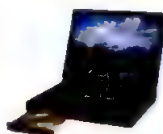
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Megapixel Multimedia

The Ricoh RDC-4300 megapixel camera adds audio recording and powerful multimedia software.

By Bruce Brown

Ricoh's low-priced (\$600 street) RDC-4300 digital camera with audio recording becomes a flexible multimedia tool when paired with its impressive software bundle. Targeted for novice to experienced digital photographers, the RDC-4300 produces clear 1.3-megapixel 1,280-by-960 resolution color images for creative uses in business and personal applications.

The compact 2.5- by 5.25- by 1.6-inches (HWD) RDC-4300 weighs just 14.4 ounces with batteries and fits comfortably in your palm. Based on a 0.5-inch CCD f2.8 equivalent glass lens, the camera also boasts 3X optical zoom, a 2-inch diagonal color LCD, and a 180-degree rotating lens. The rotating lens can be a disadvantage, as it tends to move easily with little pressure.

The camera kit includes a

4MB SmartMedia card, an AC adapter, a PC serial cable, a AV cable for displaying images on TVs, a lithium backup battery, four double-A alkaline batteries, and a welcome nickel hydride rechargeable battery set, which includes four batteries and a convenient travel charger.

There are three image quality settings for both resolutions (1,280-by-960 and 640-by-480). The quality and resolution settings determine image file size, which range from 56KB to 615KB, letting you store from 6 to 70 images on a 4MB SmartMedia card.

There's no optical viewfinder, so you must use the LCD for image composition and menu selections. The four navigation and control buttons are some-

what awkward to use since they are of different types and in varying locations. You can set the camera to shoot normal images or text (with enhanced black contrast), in either case

you capture and play images from up to 15 feet.

The RDC-4300's software collection includes ArcSoft's PhotoBase for organizing image, audio, and video files and PhotoStudio image and special effects editor.

Enroute's QuickStitch creates panoramas, and QuickStitch 360 produces QuickTime VR panoramas. MetaCreations' Kai's Power Show livens presentations with special effects,

and LogoMotion provides 3-D text and logo animations.

The RDC-4300 is a comprehensive package that produces clear, high-resolution images with audio and bundled software to captivate your audiences.

Ricoh RDC-4300. Street price: \$600. Requires: 16MB RAM, 40MB hard disk space, Microsoft Windows 95 or 98. Ricoh Consumer Products Group, Sparks, NV; 800-225-1899, 702-352-1600; www.ricohcpg.com; 404 at www.pcmag.com/infolink.



CLOSE-UP: The Ricoh RDC-4300's 3X zoom lens rotates 180 degrees.

accompanied by audio, which is saved in WAV format.

There is no speaker, but you can listen to recorded sound by plugging in headphones (not included).

Useful supplemental features include a self-timer, a tripod mount, and adjustments for shutter speed, close-ups, white balance, and exposure. An optional remote control (\$28 street) lets

Fast Film for Your Digital Camera

Lexar Media manufactures storage cards and card readers for both CompactFlash and SmartMedia (the most popular formats for storing digital images). Lexar sells 4X CompactFlash Film Packs in 8MB, 16MB, 32MB, and 64MB sizes for \$80, \$120, \$180, and \$330, respectively (direct) and 4MB, 8MB, and 16MB SmartMedia Film Packs for \$30, \$60, and \$100.

Lexar's products are designed to speed up the two major bottlenecks in digital photography: internal image processing and image transfer. Lexar's CompactFlash Digital Film storage cards, rated at 4X and based on a 750-Kbps continuous-write rate, will speed up image interpolation and compression in cameras that do hardware compression but not on most current consumer cameras, which do compression in software. In testing with a Kodak DC260 camera with software compression, a Lexar CompactFlash card did not process images faster than the Kodak card. (We tested by taking four shoots as quickly as possible to overcome data buffering.)

SmartMedia cards work with devices that have their own internal controllers. Therefore, Lexar's cards do not boost performance but allow Lexar to cover both standards. Like the Com-

pactFlash Digital Film, Lexar's SmartMedia Digital Film cards proved to be compatible with a variety of devices.

The Digital Film Readers (\$90 each format), which transfer data between the PC as a parallel port pass-through device each make transferring images to the PC significantly faster than with a serial cable. Since the PC sees both media types as hard disks, Lexar's cards can be used for other types of data storage as well.

Although most users won't see much improvement with in-camera processing speed, the convenience and speed of the card readers and the selection and prices of the Film Packs are significant benefits.—BB

CompactFlash Film Packs. Direct price: 8MB, \$80; 16MB, \$120; 32MB, \$180; 64MB, \$330. **SmartMedia Film Packs.** Direct price: 4MB, \$30; 8MB, \$60; 16MB, \$100. **CompactFlash and**

SmartMedia Readers. Direct price: \$90 each. Lexar Media Inc., Fremont, CA; 800-789-9418, 510-413-1200; www.lexarmedia.com; 405 at www.pcmag.com/infolink.

SPEED READ: Lexar's SmartMedia (left) and CompactFlash film and readers.





Nokia 446Xs



OUR ENGINEERS WERE GOING FOR A LINE-OF-SIGHT 35° BELOW EYE LEVEL.



OUR DESIGNERS WERE GOING FOR *swoopy*.

Despite their differences, vocabulary being the most obvious, the engineers and designers at Nokia are all focused on the same thing. Namely, to build the world's best monitors.

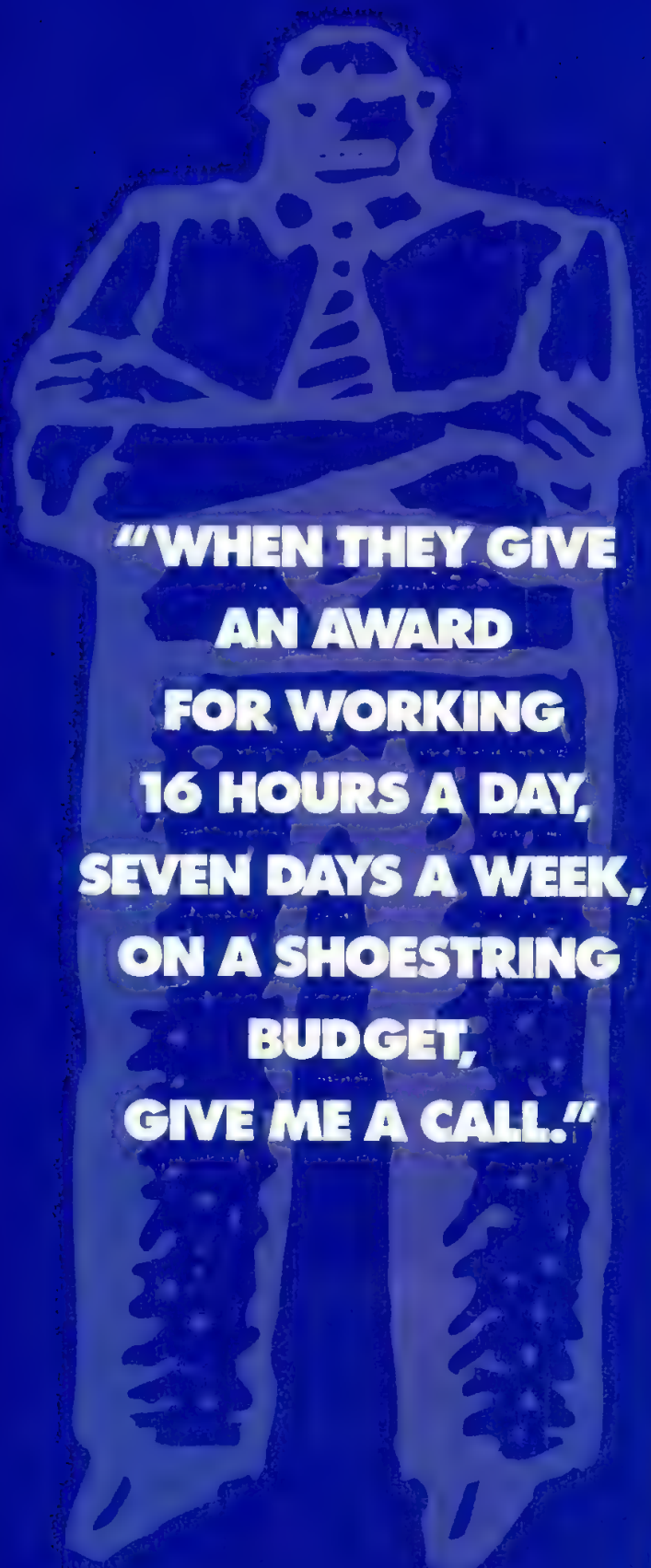
It's this unique collaboration that makes every Nokia a marvel of technology and ergonomics, as well as contemporary Finnish design.

The Nokia 446Xs is a perfect example. This sleek 19" monitor (17.8" VIS) delivers up to 1600 x 1200 resolution, up to 90Hz refresh rate at 1280 x 1024, with a .22mm horizontal dot pitch. It's a short neck CRT for a smaller footprint, but it saves considerably more than desk space.

Research shows that traditional viewing angles require your eyelids to be more open, allowing moisture to evaporate, causing dry eye and fatigue. We corrected this problem by designing the Nokia 446Xs with a lower base, allowing for an optimum viewing angle of 35° (similar to the angle at which you're reading this magazine). The monitor's lower profile helps users experience less fatigue, not only in their eyes, but also in their neck and back.

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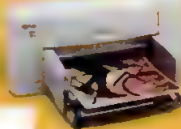
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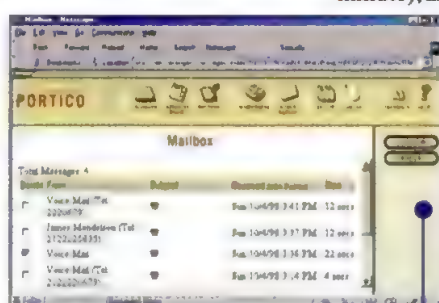
At Your Service

General Magic's Portico virtual assistant never gets tired of taking your phone calls.

By Edward Mendelson

You're on the road with only a cellular phone, it's midnight on Saturday, and you want to check your e-mail and calendar. Until now, you'd need an assistant working the night shift in your office. But with General Magic's Portico, you can dial a number and ask a cheerful voice to list your appointments, read your e-mail, send copies of the most important messages by fax, and play your phone messages.

Portico refers to its assistant as "she" and clearly aims its service at customers who like the idea of paying for the chance to give orders to a chirpy female voice that never gets tired of listening. If this isn't your idea of a good time, you may find Portico offensive. And the voice's



cheerfulness ("I thought you'd never call") gets old quickly.

MAIL CALL: Portico can play back your voice mail as RealAudio files.

Portico offers an all-in-one feature set that includes message storage, schedulable call forwarding, a voice-synthesized appointment book and calendar, news reports, stock quotations, and e-mail delivery from multiple Internet mail accounts. Pricing ranges from \$19.95 per

month for 60 minutes of usage (20 cents per additional minute) to \$149.95 per month for 1,300 minutes (15 cents per additional minute); all plans include a \$50 setup fee.

The voice recognition system responds to most commands on the first try, although you can get tangled up in options. The Portico voice can be interrupted at any time, and commands can be made at top speed using the telephone keypad. You set up your ad-

dress book and other preferences on a password-protected Web page, then interact with Portico either by phone or the Web. You can synchronize contacts and calendar entries between Web pages and standard PIMs, as well as with 3Com Palm and REX units.

You get an individual toll-free number to give to your contacts; anyone who isn't on your contact list gets the cold shoulder from the Portico voice and can't leave messages. The toll-free number also serves as an e-mail address in the form 877xxxxxx@portico.net. Using the phone or Web interface, you can change call-forwarding settings, select news and stock items, and enter items in a notebook that can't be accessed by phone, only on the Web.

Once you get used to the keypad interface and stop listening to the voice, you can use Portico quickly and effectively. But don't forget your password during a weekend or at night, because General Magic only has human beings available during working hours.

Portico. Monthly service plans priced at \$19.95 and up. General Magic, Sunnyvale, CA; 800-767-8426; www.generalmagic.com; 412 at www.pcmag.com/infolink.

Make Your PC Thunder

The AudioStorm MT7 F/X brings Dolby Pro Logic Surround Sound to any audio source.

If you don't care about music and money, read something else. If you want better audio than what comes standard with almost any PC without going broke, read on—carefully. The Gallant AudioStorm MT7 F/X (\$149 list) is a full Dolby Pro Logic system that includes an amplifier, a combined single-cabinet subwoofer and center-channel speaker, and four satellite speakers.

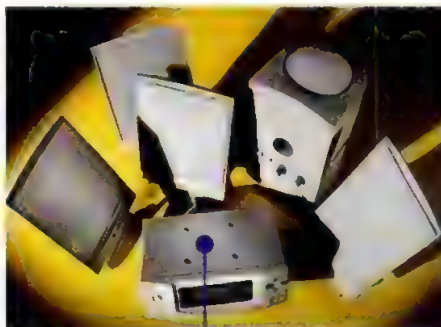
Each of the 3-watt, 5.2-by-6.9-inch (WH) satellite speakers has its own small tilting stand and is only 0.7 inches thick. A cable with an RCA jack is permanently attached to each speaker, but cable extenders are included for placement flexibility.

The satellites plug into the 12-watt subwoofer/3-watt center-channel speaker combination unit that is attached to a small

Universal Audio Decoder unit (ideally placed under the subwoofer/center-channel speaker unit). The AC power adapter cable and PC audio cable both plug into the decoder unit.

The AudioStorm MT7 F/X isn't limited to use with PCs. It accepts stereo analog audio input from video game players, TVs, VCRs, DVD players, or any other AV device (but only one device at a time can be connected). The only drawback we found was that some of the input jacks did not hold the cable plugs tightly, resulting in inadvertent disconnects if the cables were pulling on the connection.

The Universal Audio Decoder has a bright LCD and control buttons that you use to set audio mode (Pro Logic, surround, or stereo), center-channel mode



FULL SOUND: The Gallant AudioStorm includes an amplifier, subwoofer, center channel speaker, and four satellites.

(wide, normal, or phantom), and surround mode (disco, hall, or live). You can also test the channel connections and set relative volume levels with the decoder unit. Standard volume and subwoofer volume controls are on the subwoofer/center channel speaker unit. Putting together the parts

and connecting all the cables takes under 15 minutes. We tested the speakers by watching *Blues Brothers 2000* on DVD on a TigerDirect PC Cinema in Pro Logic Surround Sound mode. The quality of the music playback, dialogue, and the surround effect made us sit up straight. This system sounds better than it has a right to for so little money. The bass is steady and strong, and midrange and high-level sounds were very clear.

You won't fill a dance hall or a loud party with sound with the AudioStorm MT7 F/X, but for solo PC multimedia or even for a family room full of people watching a movie, this sound system is a fine performer and a great value.

Gallant AudioStorm MT7 F/X. List price: \$149. Gallant Computer Inc., Fremont, CA; 510-656-5887; www.gallantcom.com; 413 at www.pcmag.com/infolink.



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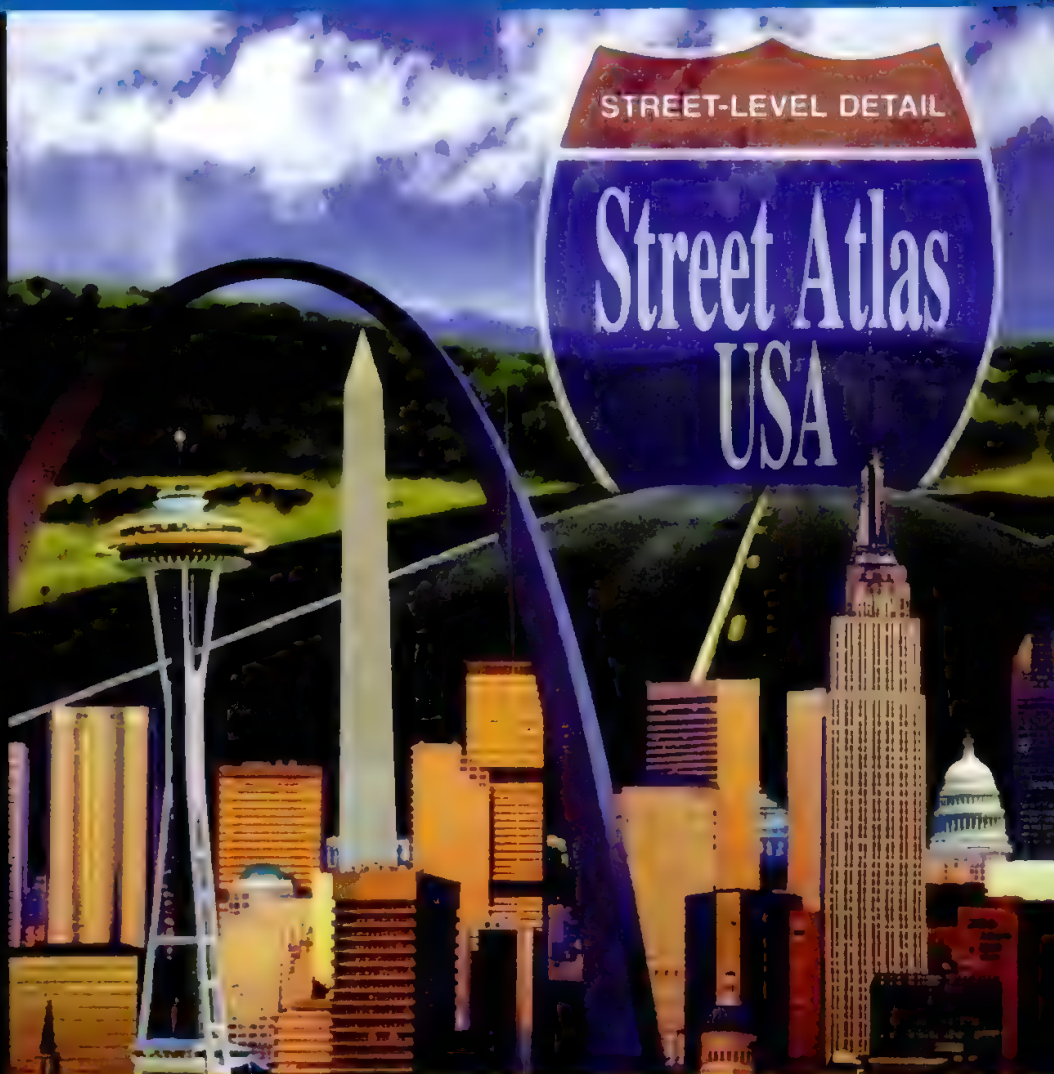


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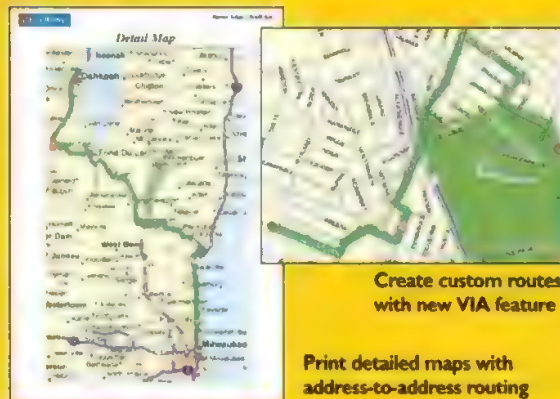
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Meet You on the Web

The new version of Meeting Maker delivers Web functionality and LDAP support.

By Robert P. Lipschutz

Long a mainstay for scheduling in mixed PC and Macintosh environments, ON Technologies' Meeting Maker 5.5 (\$95 per seat) continues to provide exceptional cross-platform support and an intuitive interface. Although the LDAP support and Internet publishing don't make 5.5 a must-have upgrade for current users, it is an excellent solution for anyone looking for easy-to-use calendaring software for small to mid-size businesses.

The measure of any group scheduling application is its ability to create meetings and manage the resources needed for them effectively. Meeting Maker's clean interface does all the basics well: Special icons denote whether a meeting is optional or mandatory,

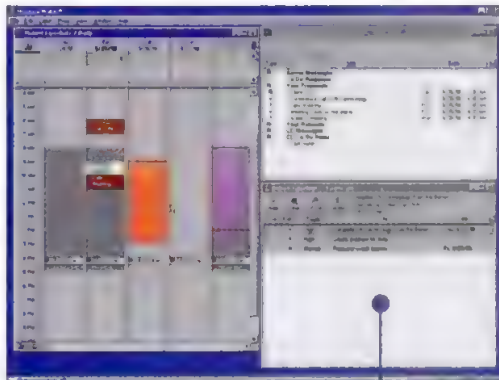
and if respondents have accepted, declined, or haven't decided.

When you schedule a meeting, you simply choose your guests, and Meeting Maker finds times when everyone can attend. Meeting Maker even has the unique feature that makes meeting notifications arrive as a pop-up window on both Macintosh and Windows PCs. The only notable oversight is the inability to find an available meeting room at a given time.

Besides its support for Windows and Mac users, Meeting Maker works with a wide range of OSs and PDA devices. Uncommon for such software, Meeting Maker has clients for both

OS/2 and Solaris. PalmPilot and Windows CE users can synchronize their appointments with third-party Puma IntelliSync v.

Exchange when you schedule a meeting or your users can create public read-only HTML versions of their calendars.



ALL AT ONCE: Meeting Maker's interface lets you see the calendar, To Do list, and messages all on one screen.

Although Meeting Maker traditionally used its own proprietary directory system, this new version works with LDAP. We found that this integration can be useful with an existing LDAP directory, but it is a painful process to start from scratch, largely because of

the nature of LDAP itself and the program's lack of Novell NDS or Microsoft directory integration.

Meeting Maker 5.5. List price: \$95 per seat; 500 users, \$45 per seat; Administration API (for LDAP), \$499. ON Technology Corp., Cambridge, MA; 617-374-1400; fax, 617-374-1433; www.on.com; 400 at www.pcmag.com/infolink.

3.0, a \$69 (list) per user add-on.

Mobile users can work off-line and synchronize when they reconnect. You can keep people outside your company informed in two ways: You can send an e-mail via SMTP or Microsoft

Jack of All Trades, Master of Most

The Team Internet 100 jump-starts network and Internet services.

By David Harvey

If you want to connect your home or small office network securely to the Internet,

Apexx has a solution with its **Team Internet 100**. For \$1,795 (list), this ambitious black box offers a laundry list of features, including mail, FTP, NAT/DHCP, and Web servers, as well as a firewall and content filtering. Despite some rough edges, we found the device delivered as promised and was a snap to use.

The all-in-one device includes a built-in V.90 modem for Internet connectivity and has a single 10-Mbps Ethernet port to connect your network. Setup is handled through the Web-based TeamPage wizard, which steps you through the configuration of the device's numerous functions

and your Internet connection. Oddly, the included ISP database lacked several key national and regional ISPs.



Although we liked the easy-to-use TeamPage management utility, we were disappointed that we were unable to import existing user databases: We had to enter each user manually. The

only way around the problem is to grant all users free access to the Internet.

Security is handled through Name Address Translation (NAT) and the included firewall. NAT and DHCP services keep your client IP addresses dynamic and hidden, and the firewall lets you select which services and application types to let in and out of the network.

Team Internet provides all its

SURFING ADMIN: All Team Internet management is handled through an attractive interface.

content filtering through a proprietary version of WebSense's software. You can filter content for users individually or by groups. To control content, you can block specific sites or canned categories. Unfortunately, you get only a one-month free trial; a 20- to 50-user license

will cost you \$400 (list) per year.

The device's SMTP/POP3 mail server works standalone or with an ISP's mail system. It took just a few minutes to set up a mirrored server and start delivering mail, and the server even comes with automatic backup and spam filtering.

You can even set up an intranet using TeamWebServer. It provides everything you need to set up a basic site, including CGI functionality, and we created a test site with little effort.

With five concurrent downloads, we still got good browsing speeds on our three networked PCs. Although these speeds are all right for the office that mostly uses the Internet for e-mail, larger networks should use the serial port to attach an ISDN terminal adapter to get acceptable speed. **Apexx Team Internet 100.** List Price: \$1,795. Apexx Technology Inc., Boise, ID; 800-767-4858, 208-336-9400; fax, 208-336-9445; www.apexxtech.com; 403 at www.pcmag.com/infolink.

Poor Man's Gigabit, Rich Man's Fault Tolerance

Multiport server NICs can give your mission-critical servers extra bandwidth and failure backup.

By Kevin Young

In the past two years, the hype surrounding Gigabit Ethernet has given way to real products. And, though networking vendors have pushed the 1,000-Mb envelope, most businesses are still using 10-Mb Ethernet. In fact, according to a Market Intelligence survey, less than 20 percent of companies with 500 or more employees plan to implement Fast Ethernet. This relatively slow transition isn't due to the immaturity of the technology but to an even more insidious beast: cost. For

most, the move to Gigabit Ethernet NICs, switches, and fiber cable is simply too expensive to consider.

There is another solution, however. Here, we review three multiport NICs for Windows NT that provide a cost-effective alternative to Gigabit: the Adaptec ANA-62044, the Compaq NC3131 Fast Ethernet NIC, and the Phobos P430-W. This new breed of NIC lets you *trunk* ports into a virtual fat pipe for throughput. (Some vendors call the process *aggregation*. Trunking and aggregation are inter-

changeable terms.) *Asymmetric trunking* means that a single port receives all traffic, but two or more trunked ports can transmit data, theoretically multiplying your outgoing bandwidth by the number of trunked ports. In *symmetric trunking*, the bandwidth of all the trunked ports is used in both directions.

This technology lets you maintain your current Ethernet and Fast Ethernet investment and eliminate bottlenecks without having to buy Gigabit switches and lay fiber. In our labs, we were able to get 300-Mb throughput with four trunked ports, which should speed up all but the most congested networks. Although not Gigabit speeds, you can add more trunked ports until your bandwidth hunger is satiated.

Trunking offers the added benefit of *port redundancy*: If one port should fail, another takes over without losing any packets. Although redundancy, or *failover*, is an added bonus of trunking, you can get its protection without trunking. With non-trunked failover, one port oper-

ates normally, and a second stays idle to take over should the first fail. Although it may seem a waste not to implement trunking for failover, the non-trunked method doesn't require a switch.

If you're solely looking for redundancy, we don't recommend these cards, as the PCI slot is still the single point of failure unless you trunk ports on multiple NICs. Look to single-port NICs for failover-only duties. (See our feature "Server NICs with Tricks" in our Net Tools section of our issue of September 22, 1998.)

Another new feature we tested for the first time is 64-bit PCI connections. Both the Adaptec and Compaq cards fit into 64-bit slots for double the PCI bandwidth. This wider bus helps overcome the generally slower performance that multiport NICs deliver compared with their single-port brethren. The Adaptec and the Compaq both support SNMP management, which allows remote monitoring and control of the NICs, especially when tied in with enterprise management packages.

The NICs also have other tricks. The Compaq card implements the proposed PCI hot-plug standard, which lets you insert and remove cards while the server is running. But both the OS and the server hardware must have hot-plug capability. Windows NT 4.0 lets you replace components only with identical ones, but Version 5.0 plans to support replacement, removal, and addition of new cards, as NetWare 4.11 and Version 5.0 do now. Adaptec is looking into the future with planned support for Virtual LAN (VLAN) capabilities, which will permit a single server

link to carry traffic for software-created subgroups. VLANs have the capability of improving bandwidth management and reducing administration headaches.

Adaptec ANA-62044

One of the first vendors to introduce asymmetric trunking in its Duralink software, Adaptec tries to build on that innovative tradition with the four-port ANA-62044 (\$695 list). Adaptec is the only company in this mini-roundup planning VLAN sup-

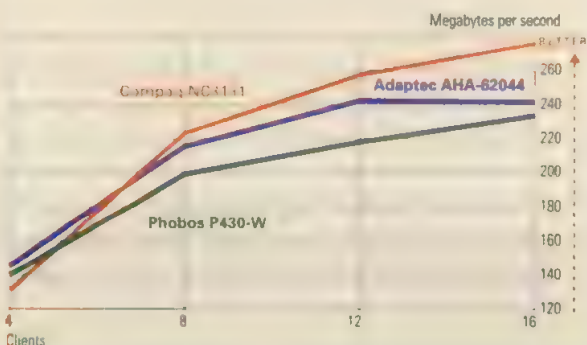
NETBENCH TEST

NetBench 5.01 NIC Test



To compare performance of these three products, we used Ziff-Davis's NetBench 5.01 NIC Test. The NIC Test built a 48MB file on our Dell PowerEdge 6300 server (4-way, 400-MHz Xeon with 1GB of RAM)

and then instructed our 16 clients to download the file repeatedly as fast as they could. We ran the test several times, varying the request size and number of clients. The results presented here are averages of the throughput for five request sizes—64 bytes, 256 bytes, 1K, 8K, and 48K. To test symmetric trunking, we used a Cisco 2924 switch capable of Cisco's trunking technology, Fast EtherChannel (FEC). Because the NetBench NIC Test sends traffic from the server to clients but not vice versa, we saw little difference between a product's FEC scores and its scores with its own proprietary method of asymmetric trunking. We did see some differences between the 32-bit and 64-bit cards, but because we were not saturating the PCI bus with other I/O traffic, we did not observe the true potential of the 64-bit bus.

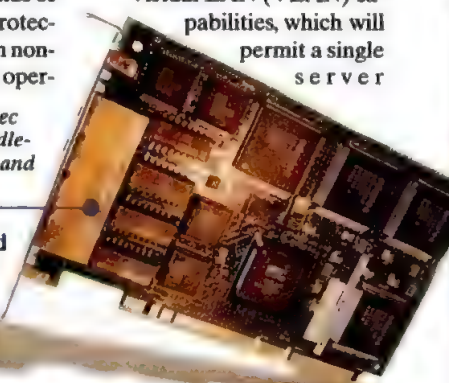


IN THE MIDDLE: The Adaptec ANA-62044 delivers middle-of-the-road performance and feature set.

ates normally, and a second stays idle to take over should the first fail. Although it may seem a waste not to implement trunking for failover, the non-trunked method doesn't require a switch.

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Another new feature we tested for the first time is 64-bit PCI connections. Both the Adaptec and Compaq cards fit into 64-bit



port, and the card includes SNMP management features. The ANA-62044 delivers good feature and performance sets, falling in the middle of its competitors.

The 64-bit PCI card has four in-line RJ-45 connectors that install as four separate NICs within NT. Unlike its single-port ANA-62011 predecessor, Adaptec uses its own NIC hardware on the ANA-62044. Our tests showed improved performance over the ANA-62011 with this proprietary chip set.

Adaptec's DuraLink software offers two configuration modes: failover and trunking. One quirk with the Adaptec drivers is that you need to decide in advance which configuration you want, because the drivers are different for each. To change from failover to aggregation or vice versa, we had to remove the drivers, reboot, then install the new drivers. Because of this limitation, there is no way to provide two sets of dual-port aggregation with failover, for example, with a single multiport NIC. Unlike the other two products, Adaptec plans to include VLAN capabilities by the middle of next year.

On our NetBench 5.01 NIC Test, the Adaptec landed smack in the middle of the pack, with a slight performance drop with more than 12 clients. In general, the throughput was acceptable but not quite up to the Compaq unit's level.

Adaptec includes software that works with HP's OpenView SNMP manager, which lets the network administrator monitor the NIC's status and throughput remotely. Adaptec's products are backed by a limited lifetime warranty and toll-free technical support during business hours.

—Jason Swierk

Adaptec ANA-62044. List Price: \$695. Adaptec Inc., Milpitas, CA; 800-442-7272, 408-957-7272; www.adaptec.com; 401 at www.pcmag.com/infolink.

Compaq NC 3131 Fast Ethernet NIC

Server NICs generally don't turn heads, but the Compaq NC3131 Fast Ethernet NIC (\$360 street) does just that. At its heart, it is just a dual-port, 64-bit NIC. What sets the NC3131 apart, however, is an additional slot for a daughtercard, which lets you add two more Fast Ethernet ports (\$285 list). Or you can add a Compaq NC 6132 Gigabit Module 1000 SX, a single Gigabit port (\$715 list). The NC3131 turned in impressive performance and includes a slew of options, such as SNMP management, PCI hot plug, and tight integration with Compaq's SmartStart server utility. If you are willing to pay a little extra—and especially if you have a Compaq server—the NC3131 is a worthy choice.

The NC3131 is simple to install, and its driver interface is the most feature-rich we reviewed here. It is relatively easy to use, and we enjoyed extra options such as detailed diagnostics. Grouping ports is logical, but other features weren't as slick as either the Adaptec or Phobos drivers.

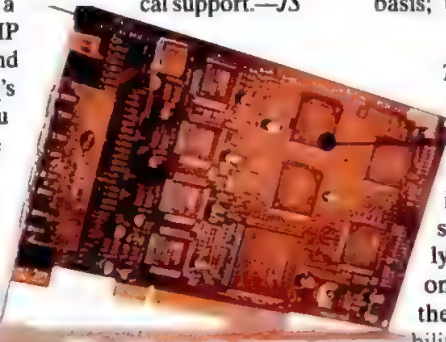
Compaq's trunking method—called *Advanced Load Balancing* (ALB)—works much the same way as the other two products. The driver can aggregate all four ports of Fast Ethernet when that daughtercard is installed, but you cannot combine the Fast Ethernet ports with the Gigabit daughtercard; that capability is planned for the first half of next year. Failover from Gigabit to Fast Ethernet should

TEAM UP: The NC3131 has daughtercards to add additional Fast Ethernet or Gigabit ports.

be available when you read this.

On our performance tests, the NC3131 topped the field. Though it had a slow start, it easily outdistanced the competition as we added more clients to the mix.

Manageability is another strong suit of the NC3131. It supports SNMP, plus DMI 2.0 and Web-Based Enterprise Management (WBEM)—not found in the other cards. If the NC3131 is installed in a Compaq server, its integration with SmartStart allows automatic configuration during the initial server setup. If you have problems, Compaq backs the card with a lifetime warranty, and free, round-the-clock technical support.—JS



Compaq NC3131 Fast Ethernet NIC. Street price: \$360. With the **Compaq NC3132 Fast Ethernet Module Dual 10/100:** \$285 (list). With the **Compaq NC 6132 Gigabit Module 1000 SX:** \$715 (list). Compaq Computer Corp., 800-345-1518; www.compaq.com.

Phobos P430-W

The server NIC market is dominated by stalwarts such as Compaq, Intel, and 3Com, but now Phobos—a new company with several Unix NICs under its belt—is entering the Windows NT marketplace. Though the four-port, 32-bit P430-W (\$695 list) isn't the fastest card we test-

ed, it provides a core feature set for servers lacking 64-bit PCI slots and delivered acceptable performance.

As with the other cards, the P430-W offers both symmetric and asymmetric trunking and failover, but it lacks some of the competition's features, such as SNMP management and PCI hot plug. But its driver interface was clean and easy to use, offering intuitive access to the available features.

By the time you read this, Phobos will have a new version of its GUI that lets you specify three different methods of trunking. Currently, outgoing symmetric and asymmetric traffic is balanced dynamically, sending traffic from the least active port. One new method will allow a round-robin approach, where traffic is routed to a different port on a packet-by-packet basis; the other is a static

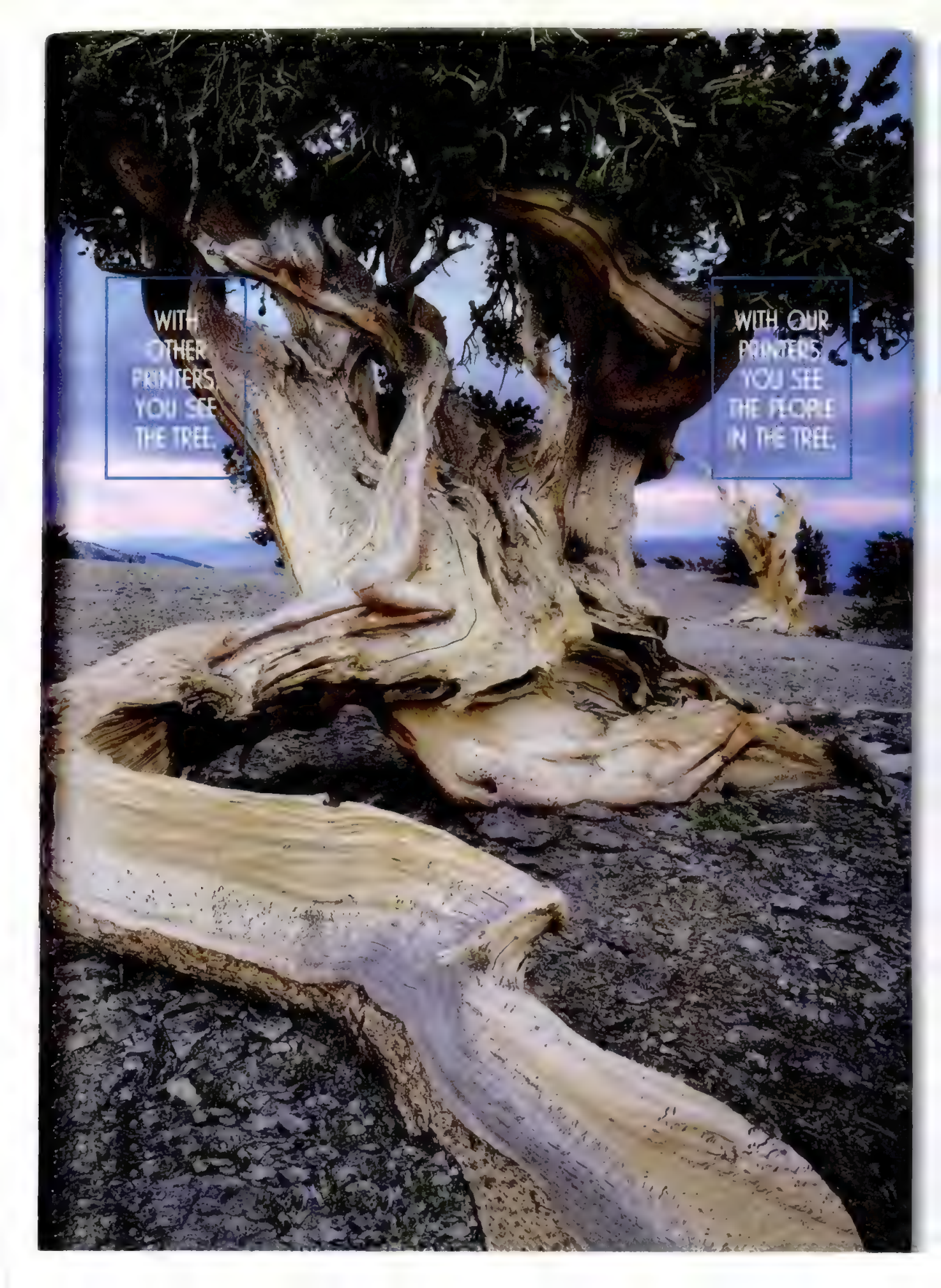
NEW KID ON THE BLOCK:

The P430-W is Phobos's first Windows NT network adapter.

trunking method, tying a client's traffic to a specific port indefinitely. Phobos will be the only company offering these flexible new capabilities.

Although the Phobos P430-W finished last in testing, its performance falls within the acceptable range. Our tests didn't take advantage of the 64-bit bus, so its 32-bit architecture didn't have an impact on the results. The P430-W lacks the management features of the other cards, but if you get into trouble, Phobos backs the cards with a three-year warranty and free technical support during business hours.—JS

Phobos P430-W. List Price: \$695. Phobos Corp., Salt Lake City, UT; 801-474-9200; www.phobos.com; 402 at pcmag.com/infolink.



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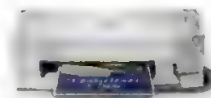
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AOL 4.0 Users Appreciate Advances

By Bruce Brown

We followed America Online 4.0 through its beta stages and enthusiastically applauded its improved e-mail, Weblike navigation, customization, content breadth, and easier upgrades. On July 30, when America Online officially released Version 4.0, we posted our review with praise for its improved features and interface. We still like AOL 4.0 after several months of near-constant business-day use. But some nagging problems remain.

Many readers posted messages in praise of the new e-mail features, online content, and the new ability to switch between screen names without needing to reconnect. In our use of the program, we've noticed that screen name switching isn't always available: At times a notice will pop up saying that usage demands preclude the activation of this feature.

Some users have mentioned initial connection problems, but more have reported being unexpectedly cut off from the service. It's usually difficult to tell whether cutoffs occur because of bad phone connections, local sys-

tem problems, or hiccups by AOL. We've noticed that at times it's hard to stay connected, with no apparent actions on our part. We've been able to make the initial connection much more easily than with AOL 3.0, however. Certainly, getting on AOL and staying on is easier now than it was a year ago, and this is true in the face of an ever-increasing membership.

Ads abound in AOL, and the service's subsections often include sponsor buttons or banners. Although many respondents have taken great offense at the

advertising, we accept the ads as a consequence of the medium. Spam continues to be a bother;



people sometimes delete messages they would have wanted to read, since the mail gets lost in the cesspool of online solicitation.

Service upgrades and new features continue; for example, Per-

sonal Page Publisher 3.0 is now available for easy home page creation. Program feature upgrades still occur automatically when you access specific features. This helps, because it keeps you updated incrementally, but it's also a pain when you want to look up something fast and are delayed during a download.

TUNE IN:

AOL 4.0's Games Channel is the place to go for information and tips about the hottest PC and video games.

AOL 4.0 seems to be delivering on its promise of better access, easier navigation, and more content.

Eudora Pro 4.1 Improves Web-Centric Functions

By Greg Alwang

When we last looked at e-mail clients, Eudora Pro 4.0 was one of the most popular Internet mail clients, but it was rapidly losing ground to Microsoft Outlook 98 in breadth of mail management features. Qualcomm has since released a dot upgrade to Eudora, adding several key features.

The most significant new fea-

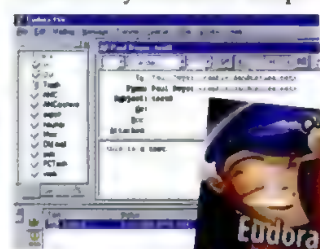
ture in Eudora Pro 4.1 is support for background tasks. In Version 4.0, all sending and receiving of mail occurred in the foreground, requiring you to wait until the process was completed before you could go on to other e-mail tasks. This was especially cumbersome with large volumes of messages or slow mail servers. Version 4.1 checks mail in the background, letting you compose or read mail simultaneously. A new task-status window shows you the progress of background activities and details any errors during background tasks.

Qualcomm has made additional changes that will appeal to e-mail power users who want to control background operations. Advanced users willing to edit INI files can control such settings as the number of accounts to check simultaneously.

IMAP support has been improved, and key updates have been added to the Extended Messaging Services API, making developing third-party plug-ins for Eudora easier. Version 4.1 supports Apple's QuickTime 3.0, letting you view embedded graphics in incoming messages.

The installation is more

streamlined and Web-centric, letting users download core updates from Qualcomm's Eudora site (www.eudora.com). During installation Eudora detects whether any additional compo-



nents, such as

QuickTime, need to be updated and automatically routes you to the appropriate download sites. This means you can update Eudora and all related components online and in one concise step.

For users migrating from other mail systems, Eudora Pro 4.1 has expanded support for importing Microsoft Outlook 98, Outlook Express, and Netscape Navigator mail settings, messages, and even address book entries. A new spell-checker underlines misspelled words in red, easing the task of catching errors. The addition of these features enhances Eudora's appeal as a mail management tool.

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Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of AOL 4.0.

AOL for no one. AOL is just as much not for the novice as it is not for the expert. Everything that you can do on AOL, you can find on the Internet with even more information. So why is AOL better than any other ISP? AOL limits your online experience by kicking you off every 46 minutes if you want to do some non-AOL Internet stuff like games. AOL gets a big thumbs down from me.

—Daniel

AOL is still the one to beat. Gripe, gripe, gripe . . . and yet, AOL remains far ahead of any other ISP in membership. It did not get there, or stay there, because it is rotten. The new 4.0 interface is much improved, switching names without logging off is terrific, and the e-mail/chat continue to shine. I have been using AOL since it started—still prefer it over all others—and, even with all of its faults, I find AOL 4.0 to be better than the rest.

—John B.

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Remember Pen Computing?

"This product isn't for you, Bill." I can't tell you how many times I heard that phrase—from Microsoft folks, PR firms, and vendor reps—as I saw early and then production-quality samples of the new Vadem Clio hand-held, a Windows CE device. In truth, this product is for me. It is compact and silent,

has great battery life, and would be unobtrusive if not for its bold, attention-getting design.

The Clio's most outstanding feature is the flip-over 640-by-480 screen, supported by two magnesium arms. You can tilt the screen toward you and type, as with a conventional laptop, or you can flip it over and close it over the keyboard for pen-based use. Check out www.vadem.com for a look if you haven't seen the device yet.

I brought a Clio with me to a daylong tour of research labs yesterday. Some of the presentations were sit-down formal, in which I was taking notes in a darkened conference room. Others were in scientists' cramped offices and labs, where I was shoulder-to-shoulder with other journalists. Normally I'd have put my laptop back in my bag and taken notes on a reporter's pad. Instead, I just flipped the screen over and kept writing in the same Pocket Word document with the provided stylus.

This was either brave or foolhardy, because I had no idea what the proper gestures were for carriage returns, spaces, selections, or deletions. I hadn't even read any of the online documentation. Fortunately, it recognized my handwriting well enough that I could read what I had written at least as well as I would have from my scrawled notes. Through trial and error, I figured out the return/enter gesture; I ignored the correction gestures until I got home that evening. Then I read the CalliGrapher help file and Web site for the full story.

I'm surprised at how much I like the Clio, given my longstanding abhorrence of things CE. Although I have no use for the palm-size Windows CE devices, I find this one rather nice. Once again, the truism of waiting for Microsoft's third-generation product bears out. I can write and work with spreadsheets, simple databases, and calendars. I can sync with my PIM and use the browser to read my POP mail. The browser is slow and crashed once (on Vadem's site), and it lacks some of the sophistication you've come to expect from 4.x browsers. But the Clio weighs a smidge over 3 pounds and runs for 12 hours on battery power. Can your laptop do that?

Pen computing clearly wasn't dead; it was only sleeping. The last big run at pen-based computing was accompanied by names such as Slate, Go, and of course Microsoft, although Pen Windows 3.1 was probably one of the things that drove it into a coma. On the whole, pen-based computing was a dismal failure—the answer to a question that nobody was asking. One company (Dauphin) was there at the beginning, however, and it's still here.

The company's latest is the Dauphin Orasis, a two-fisted, 233-MHz pen computer that runs Microsoft Windows NT or 95. It weighs 4.5 pounds and gets only around 3 hours' battery life. But it runs all your existing applications, has all the I/O ports you've come to know and love, and has a rugged 2.1GB hard disk.

While Vadem has pursued the fickle consumer market, Dauphin (www.dauphintech.com) has been selling to vertical markets such as law enforcement, military, medical, and other field- and location-oriented markets that require large amounts of information on hand, on-the-spot data collection, and simplified user interaction. In addition to pen input, the Orasis also offers voice input capabilities. It's a full PC, complete with Sound Blaster emulation. A hard disk or floppy disk drive can clip onto the back of the unit, and Dauphin offers a modular expansion bay that can hold application-specific devices, such as GPSs, wireless communication transceivers, and additional batteries.

The pen is tethered to the unit by a strong, thin, nylon cord. I thought this was cheesy at first but later realized the wisdom, because the Orasis uses an electromagnetic pen that would be expensive to replace. The advantage to this system is that your hand or fingers on the screen won't affect character recognition, as they do on the Clio. The Orasis's keyboard is a separate, infrared unit with full-size keys and excellent feel.

The Orasis and Clio are only two units in what will surely become a burgeoning market for alternate input and portable devices, but they're a fascinating study in contrast and a healthy indicator of the breadth of the market. **PC**



Given my abhorrence of things CE, I'm surprised how much I like the Clio.

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Ten Predictions for '99

Since the upcoming year is the last before the odometer flips to 2000, one has to assume that no matter what happens, it'll be overanalyzed by historians and pundits alike. Because the importance of things in 1999 (including anything carried over from 1998) will be exaggerated, it's a perfect time for me

to try to outguess the market and the future. These are my end-of-century predictions.

Price becomes king, again. We're already seeing hints of sub-\$500 no-name computers, and we can expect the \$500 price barrier to be broken forever by the end of 1999. This will probably both save and kill the PC market, and it will change the way we think about computers in the 21st century. Sub-\$500 machines will bring the mass of humanity into the fold, and they'll turn the scene into a commodity business not unlike the market for stereo gear or VCRs.

Retail is stronger than ever. While everyone is raving about the emerging e-commerce scene and how it will change the face of the world, retail is bigger than ever. Industry observers seem to be ignoring the fact that Gateway (one of the leading direct-sales companies) now has 94 retail stores, with plans for more. IBM is on the verge of opening a worldwide chain. In 1999, this phenomenon will burst onto the scene to the surprise of everyone—everyone who hasn't been paying attention, that is.

Desktop flat-panel becomes the standard. The new digital flat-panel screens are so hip and cool that while the masses will be buying cheap machines, the serious computer users (like you) will be spending their money on these new displays.

Broadband cometh. With every phone company jumping on the ADSL bandwagon while cable modem technology begins to proliferate, 1999 will be seen as a turning point for broadband on the desktop. It will probably still take a decade to unfold. Gigabit Ethernet will be seen in the same light. The majority of users will probably stay with slow connections and old browsers, and 1999 will be a year of decisions. The big decision will be whether to make a Web page fancy and slow or simple and fast for those folks who don't wish to keep up the pace.

Optical everywhere. Optical technologies have sputtered over the years, but the turn of the century will mark their emergence as a permanent part of the landscape. DVD will finally become standard, and everyone will own one form of write technology or another.

With blank CD-R disks a buck and a half at Costco/Price Club, you know something will be going on!

Personal firewalls are coming. This is my pet prediction. As people get attacked more and more by TCP/IP exploits, there will be a serious demand for personal firewalls. Also, as horror stories emerge about industrial and personal espionage (mostly e-mail tampering) the public will demand portal-to-portal encryption.

Internet mania is over. As this is written we are already beginning to see a slowdown in interest in the Net. People are seeing it for what it is: a network!

Ancillary-network mania is about to begin. I'm referring to home and small-office networks, which should become ubiquitous once the big boys start to market them properly. I'm amazed at how many small offices don't have simple networks installed. The home network will allow people to share an Internet connection, which should be reason enough for installation.

The Palm phenomenon continues unabated—with a twist. I'm an advocate of the Palm computer and other hand-helds, but I haven't completely written off the remote-data concept developed by AT&T Wireless and others, whereby you have a phone that can access your address book over a wireless network. Most interesting in this regard is the Qualcomm pdQ Smartphone, which has a Palm organizer built in. This is all heading toward an all-in-one device.

Software is dead. People are wondering why there is a slowdown in the industry without noticing that there's a paucity of interesting new software products. This is less a function of lost creativity than of filled categories. Developers have filled all the general-purpose niches, and their products have matured. Most don't ever need to be updated! I'm writing this column using a text editor that's at least ten years old.

Is there an overriding theme to all this? Yes, things are always subtly changing in this industry, and predictions like these are common. But because these changes and others are taking place at this juncture, we can expect many to be blown out of proportion. Let's wait and see.



Expect the \$500 price barrier to be broken forever by the end of 1999. This will probably both save and kill the PC market.

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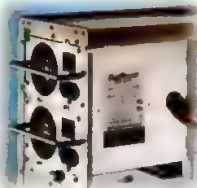
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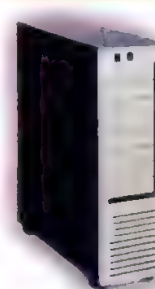
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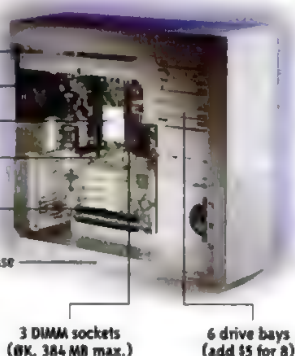
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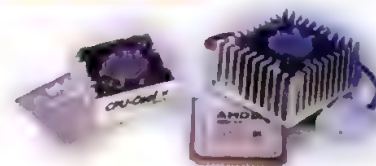


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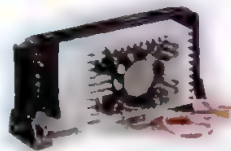
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INSIDE TRACK

Digital Photography Heats Up, Changes Name Dept.: Digital photography is over! Well, **in name only**, because Olympus is pulling an interesting marketing stunt in an attempt to get Kodak to play follow-the-leader. Olympus is introducing the term **film-less camera** to promote its—uh—digital cameras. The company thinks this will be more acceptable to the public at large. The term *digital camera* is out!

I recently got a look at the **newest offerings** from Olympus and have to admit that the company is leading the pack, which is now only two serious companies and a lot of **lost souls**. Kodak and Olympus own the market for cameras, with the exception of Sony's hot-selling but gimmicky Mavica. Sony invented the 3.5-inch disk drive, and, to me, this camera is a disk drive with a lens.

A screwball idea, but one that caught on.

I assume that Sony will try to adopt its new high-capacity drive for some future camera, because this thing is a best-seller. The idea of having a mechanical device such as a floppy disk drive inside a camera is kind of lame, and this camera is **not** what I recommend.

Take a look instead at the new Olympus D-400L, which has the **pocket camera** form factor. It competes with the Kodak DC210 but adds numerous features (such as a 3-to-1 zoom) that Kodak will now have to deliver. It should hit the streets at around \$600 or \$700. Even more interesting is the high-end Olympus D-620L (\$1,000 to \$1,200), which uses **dual processors** to deliver two **fabulous features**. First, the camera has a built-in buffer that lets the user **instantly shoot** picture after picture at about 3 to 4 frames per second. Anyone who has ever used a digital camera knows that this is a **breakthrough**. The D-620L also has the circuitry for a remote flash, so you can hook the camera to a bigger flash or a studio setup, and it will sync up and adjust for the big lights. Very cool camera.

I assume that Kodak will follow suit with some similar features, but the bigger question is, **where are the rest of the camera makers?** The problem seems to be in Tokyo. The Japanese companies are suffering from their normal marketing myopia. This results in people making decisions in Tokyo who don't understand the American market. **Old story**.

Genuinely Interesting Software Segment Dept.: Meanwhile, as people are complaining about the moribund software market, there are a couple of categories in which there is some **fun action**. One is the photo-manipulation tools market, with lots of highly competitive packages, and the other is in the new generation of Web development tools.

The newly offered Microsoft PhotoDraw 2000 is the quickest way I've ever found to design a jazzy logo or a quickie graphic with

a shadow and 3-D effect. It's essentially Microsoft Picture It! on steroids. Anyone needing to beef up PowerPoint presentations or Web graphics should buy this product without thinking twice. **Fabulous**. Best user interface of all.

PhotoDraw is part of the ongoing Adobe PhotoDeluxe-versus-Microsoft Picture It! battle. I expect to see a lot of cool stuff come out of this real competition. The coolest may be Adobe ImageStyler, an **unusual offshoot** of Photoshop that is nothing less than **phenomenal**. And while it takes some getting used to, once you find the templates, you can make a **Web page so incredible and advanced** that nobody will believe you did it. I'm talking about a page with glowing buttons and **eye-popping Java** graphics. This thing is dynamite. And I was able to load the Java-laden page into WebExpress and edit the links effortlessly. Just buy it!

From there you can move over to the Macromedia products, the most interesting of which is Flash. Flash is an **underpromoted plug-in** that most users don't even realize they have installed. It lets you animate a page with small amounts of code and is one of the **hottest Web technologies available**. Along with Macromedia Dreamweaver, Fireworks, and Generator, the program allows you to do some very advanced sites.

Just as Microsoft PhotoDraw has a personality and interface identical to those in Picture It!, and Adobe ImageStyler has the Photoshop feel, Macromedia has its own personality too. Because Macromedia's products **stem from a long Mac tradition**, these are **perfect products** for the Web developer trying to make the transition from the Mac world to the Windows world.

Exactly how well all these new tools will do over the next few years remains to be seen, because product categories **consolidate over time** as dominance grows. Microsoft is actually in the weakest position here, because its products are not available in Mac versions, and the Mac still has the market for professional graphics cornered.

This jumpin' scene reminds me of the heyday of the utility market, when Central Point, Fifth Generation, Norton, Paul Mace, and Symantec all competed for dominance. Symantec eventually bought up Norton and Central Point and soon consolidated everything into one product. In the process **the market tragically shrunk**. Overlooked in the frenzy was the fact that most users had two or more of these utilities packages. People don't have a problem buying more than one product within a category. If you cut the competition in half, you cut sales in half too. Let's hope that competition remains in this category; it's a lot of fun to watch. **PC**

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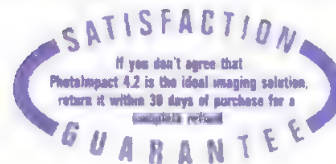
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This Year's "Christmas PCs"

The notion of the "Christmas quarter" in the PC business is well established: It's that three-month period leading up to the Christmas holidays, during which we all supposedly run out to buy our new home PCs. I suspect that a disproportionate number of Christmas-quarter PC buyers are newbies, not

the more experienced, sophisticated, performance-hungry readers of *PC Magazine*.

Still, a lot of us *will* buy new PCs this Christmas season, replacing our creaky old Pentium 90s and 133s—to say nothing of the 486s we thought we'd run forever. This isn't a bad idea, because there are some great buys right now in high-performance machines.

Note that I said *high-performance*, not *low-cost*. Yes, the "subzeros"—the flock of sub-\$1,000 PCs that have taken over the majority of the home market—are out in great number and improved over last Christmas season's models. Even better for the determined bargain hunter, this year we're seeing the first of what I call the "half-zeros," the first machines under \$500. With some as low as \$399 (without a monitor), these ultra-bargain-priced PCs will get a lot of attention.

But you and I know these aren't the machines for you.

Just as \$99 three-color ink jet printers look cheap but hardly qualify as long-term bargains, the subzeros and half-zeros aren't smart buys for those moving up from an older machine. Once you've learned what PCs can do and gotten accustomed to serious performance boosts in each successive machine you buy, you don't want to buy that far down the ladder. Even if you don't demand the very highest performance, *PC Magazine* readers typically want—and arguably need—something with a lot more punch than a bargain-priced box a year or more behind the power curve.

I can recommend two knockout, performance-oriented home PCs I've been working with lately. Although neither is at the bottom of the price scale, both offer far more value for your dollar than you'd have been able to find six months or a year ago.

Why two? Because despite the bargains available in the direct channel, a lot of home-PC buyers are still wary of ordering over the phone or the Web. They want a system they can touch, pay for, and carry out the door of a retail outlet. Not long ago, that meant overpaying for a typically underpowered PC—at least, by comparison with the configurations

and prices offered by the best direct marketers.

Today that isn't necessarily so; the premium you pay for buying at retail is far, far smaller. And some very hot machines are available in the retail channels this Christmas season.

Such is the case with my first recommendation: the new IBM Aptiva SE7, with the IBM T55A 15-inch LCD monitor. This is a powerhouse system, with a 450-MHz Pentium II processor, 128MB of RAM, a fast 16.8GB hard disk, a 56K modem, fast video, DVD-ROM, and great sound. But the SE7 isn't just about performance, it's also about looks. Put simply, the combination of the SE7 and T55A makes for the best-looking PC I've ever seen.

If Apple's cute iMac has become, to twist an earlier Macintosh line, "the computer for those of us who are embarrassed about having a computer in our homes," the SE7/T55A combination is "the computer for those of us who are proud to have a computer in our home." If this system doesn't win most of the industrial-design awards for 1998, there is no justice.

One downside: IBM's software bundle with the SE7 includes Lotus SmartSuite, Norton AntiVirus, the World Book Encyclopedia, and a few more titles, but not the ubiquitous Microsoft Office, and only one ho-hum kids' edutainment title.

You can buy an SE7 for about \$2,000, and a T55A for a little under \$1,000 at retailers; shop around and you'll find them bundled for \$2,999 or so. That's not cheap, but if a \$3,000 home PC system is within your budget, you won't be disappointed in this one.

My second hot tip, for those comfortable with buying direct, is the Dell Dimension XPS R4xx series. Picking a machine from the dizzying array of configurations Dell offers is tricky, but let's start with the XPS R450, which has a 450-MHz Pentium II CPU, a 13.5GB hard disk, a 56K modem, a 17-inch monitor, an 8MB ATI graphics card, DVD-ROM, and the Turtle Beach Montego sound card driving the really exceptional Altec Lansing ACS495 surround-sound speakers. That runs about \$2,500 and includes Microsoft Office 97 but no games or other family software. If



Subzero PCs are not smart buys for those moving up from an older machine.

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Either way, IBM or Dell, you're spending from \$2,500 to \$3,000, which is admittedly a long way from the \$1,000 to \$1,500 most subzeros finally cost. But both systems are rock-solid, wicked fast, and likely to keep you happy—and out of "trade-in time again?" hell—for some time to come. Which one? You choose; you won't go wrong.

Not everyone's shopping for a new PC this year; many of us have relatively new machines on our desks or laps now but want to add new functionality. Here are a few more suggestions for Christmas computer-gear buying.

Last issue I raved about the 2X Creative Labs PC-DVD Encore Dxr2 kit, which adds DVD movie playback to your PC. *Sic transit gloria*: It's just been replaced by an even better 5X third-generation DVD drive. If you have a Pentium/200 or faster PC—but an older, slower CD-ROM drive—consider spending \$200 for an Encore 5X upgrade kit. You'll get a 5X DVD drive, MPEG-2 decoding, and a 20X CD-ROM drive.

Creative Labs is also selling a new DVD-RAM drive kit (although only via its Web site, www.creativelabs.com) that records up to 5.2GB on dual-sided disks and functions as a CD-ROM, DVD-ROM, and audio CD player. (You'll have to buy a separate MPEG-2 decoder card to watch DVD movies.) Write performance is on the slow side, but hey—that's 5 gigabytes per disk! A \$499 bargain, with an Adaptec SCSI card.

Two more: If you don't have a scanner, consider the compact, easy-to-use Visioneer PaperPort OneTouch (\$175). Travel a lot with a PC? Get the Port Retractable Phone Cord, which hides an 8-foot phone cord in a credit card-size case (\$15).

Finally—this is the *Christmas* season after all!—think for a minute about a small gift or two for others who don't share your privileged life. Forget the digital stuff for a while and reach out to the elderly, ill, homeless, and others in your community who need your help and your touch.

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The Best Home PC

"What's the best home PC?" That's the question I'm most commonly asked by neighbors, relatives, commuters, and travelers, notwithstanding the fact that *PC Magazine* is a business-to-business magazine. There's always more interest when it's your money you're spending instead of your company's. Here's

my take on the home and SOHO PC markets. My advice in a nutshell: Compare keyboards carefully, get a big monitor, and don't be such a cheapskate.

Keyboards are where you see the biggest difference between true home PCs and generic could-be-home/could-be-business PCs. A good home PC keyboard has CD/DVD-player controls, a volume control and mute button, a one-button Internet launcher, and telephone answering-machine controls (including the blinking message-waiting light). HP does the best job with its higher-end Pavilions, primarily because of the huge volume control button. I was less enamored of keyboards that have several rows of equally spaced, equally sized buttons. Some vendors put these controls on their monitors, which locks you into buying their monitors, or on the system units that may be sitting on the floor.

Monitors are so cheap now that you really owe it to yourself to get a 17-inch display and run it at 1,024-by-768 resolution. And think seriously about the 19-inchers. I'm a big fan of 19-inch monitors running the less-heard-of 1,152-by-864 resolution. LCD panels are dazzling, and you can now get a 15-inch, 1,024-by-768 panel for less than \$1,000. LCDs make sense only if you want to impress your neighbors or if you're trying to fit a PC into a small apartment, but if that's the case, maybe you ought to get a notebook.

The right price to pay for a home PC is \$1,500 to \$2,000, not \$1,000. The one exception is if you want a second or third PC for surfing the Internet, checking e-mail, and word processing. Most \$1,000 machines are not as well built, PC Magazine Labs discovered during system teardowns, but by the same token, components are so reliable that even a poorly built machine using the cheapest available parts still won't break. Probably.

The bits-and-bytes part is clear: Look for the biggest hard disk you can afford. Get 64MB of system RAM and lots of video memory (8MB is good, but 16MB is great). There should be an internal V.90 modem installed. Personally, I'd go for a DVD drive over a CD-ROM drive.

The AMD K6-2 and the Intel Celeron are fine entry-level CPUs, though you want a 350-MHz to 450-MHz Pentium II for the midrange or high end.

A couple of PC manufacturers are putting ports on the front—Sony with video, Compaq with USB and IEEE 1394 (FireWire), and HP with serial (called a "digital camera port"). USB audio may be the future, but most PCs we tested still used analog speakers.

As for software, there's not much to say. Bundles are smaller, because PC vendors don't want support hassles from 35 different apps. Some direct vendors will let you buy software packages for \$50 to \$100 at purchase time. That's a good deal.

Here are some catch phrases to watch for. *Cable modem-ready* means there's an Ethernet card installed; you connect that to the cable modem you rent from the cable company. *USB-powered* and *USB-controlled* speakers are analog speakers that draw power from the USB port and let USB control the volume level, respectively. If you want USB speakers completely driven by digital signals, make sure the CD-ROM or DVD drive supports *digital audio extraction* of the audio information.

Odds are, no PC is going to have everything you need. For instance, one of the neatest features I've seen this year is on Acer PCs targeting mostly novice, first-time buyers. Called TimeMachine, it's a hidden archive of configuration settings and drivers. Every time you add software or hardware, it saves the old configuration, making system snapshots daily for a week, then weekly for a month, then monthly. When Microsoft Windows blows up on you—remember, this is a *when*, not an *if*—you simply go back to the last good configuration.

Regardless of which PC you buy, you'll probably want to buy a better mouse (\$20 to \$50) and possibly better speakers (\$75 to \$250). Those are the weakest parts of many home PCs.

By the way, you want a PC, not a Mac. The iMac is cute, and it's quick to set up, but it's quirky, not very expandable, there's not as much good software, and it's not as fast as Apple would have you believe. **PC**



In case you blinked, the Pentium MMX that debuted last year is already gone.

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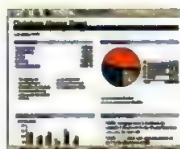


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The price pressure on the computer market from sub-\$1,000 PCs means it's bonus time for home PC buyers willing to spend a bit more. Dream PCs once cost \$5,000. Today, most of us would be happy with the performance and features of a \$1,500 to \$2,500 PC.

But while PC prices have improved tremendously, we haven't seen a commensurate improvement in ease of setup, configuration, and use. A little over a year ago, Microsoft and Intel first drew attention to ease of use, in part to spur more sales. PC vendors—particularly those building home PCs—have responded, providing setup aids, task wizards, and better troubleshooting materials in print, on disk, and online. However, these measures only scratch the surface of an ease-of-use problem that goes hand in hand with the PC's flexibility and power. Home users depend on their PCs to help them balance personal budgets, create multimedia reports for school or work, surf the Web, and more, but are often frustrated when their systems are not as easy to use as copiers, fax machines, and VCRs. Apple systems, which operate in a

more controlled environment than PCs are a little easier to use but have different trade-offs, such as price or upgradability (see "Apple in the Home: The iMac and Power Macintosh G3").

In this roundup, PC Magazine Labs evaluates ease of use along with our more typical comparison of components, performance, and prices (see "Ratings"). We created a test script with 187 questions that go beyond color-coded cables or setup posters and delve deep into documentation, on-disk and Web-based help, tutorials, and more. Troubleshooting/support is a relative bright spot for most, but learning/usability needs improvement. Ease of use will continue to be a focus for us.

Home PCs

By
Bruce Brown

Home PCs are useful and affordable, but are they any easier to use than before? PC Magazine Labs tests 24 home systems from 13 major PC vendors to find out.

REVIEW CRITERIA

We requested two types of PCs from select home PC vendors: units meant for high-volume sales with target prices at about \$1,500 and high-end (but not gamer) home systems priced at about \$2,500, both including monitors and Windows 98.

For high-volume, or mainstream, home PCs, we required a 300-MHz CPU,

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64MB of RAM, a 6GB hard disk, 4MB of graphics memory, a CD-ROM or DVD drive, and a 15-inch monitor. The minimum for high-end systems was a Pentium II/450 CPU, 128MB of RAM, at least a 10GB hard disk, 8MB graphics memory, a 2X DVD drive, and a 17-inch monitor.

CTX declined to participate. The Acer America Aspire 2100, targeting first-time buyers especially, was not ready in time, and Compaq chose not to submit a mainstream unit though it is a market share leader in the sub-\$1,500 class.

Two mainstream units came with the new Intel Celeron/333 chips, which have 128K of L2 cache (previous Celerons had none). You'll find new Celeron PCs priced about \$200 higher than the new AMD K6-2-based PCs. Prices of Pentium II/350-based PCs overlap those of high-end Celerons, although the former perform better; top-of-the line Pentium II/450 PCs start at about \$2,250.

We allowed one overqualified PC: the \$3,999 Gateway GX450-XL, powered by a Pentium II Xeon/450, a CPU positioned for

workstations or servers. For the extra \$1,500, you get only 5 percent more performance than our next-highest Business Winstone 99 scorer, the high-end Micron.

OTHER CATEGORIES

For this story, we did not look at sub-\$1,000 PCs. In our last roundup of these PCs (September 1, 1998) we found some good values but noted that savvy buyers should be wary of the compromises: a slow processor (AMD K6-2/333 or lower), poor or no 3-D graphics support, rudimentary audio features, smaller hard disks, and small monitors with low-quality screens. However, if all you'll be doing is simple productivity tasks and some Web surfing, you'll be satisfied.

EASE OF USE

As PC Magazine Labs took a close look at ease of use for the first time, we discovered exactly what you'd suspect: there's a little that's truly "easy" about PCs.

First-time buyers will find trouble:



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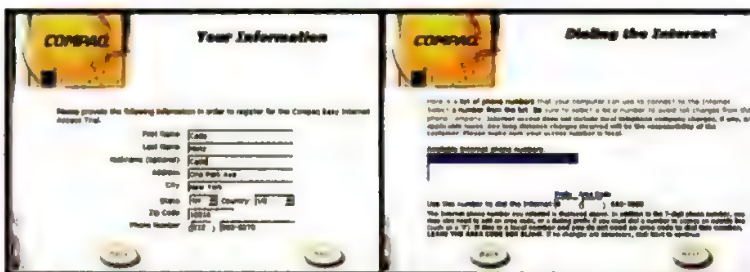
Join us online for an interactive look at the features of **26 systems** for the home: **24 PCs and 2 Apple units.**

Vendors fared badly in the area of helping you set up your PC and start using it. Several vendors offer quick-setup guides, good documentation (either in print or on disk), and color-coded cables or clear labels on their ports—good for physical setup. But it was the rare vendor that really helped you set up your system for Internet use or taught you basics about your software. Compaq, Dell, and HP (the high-end system) did best here.

High-end systems tended to have convenient extra touches—such as programmable buttons for one-touch application launch, external hardware CD or DVD control, or alternative interfaces that improve Windows' ease of use. The Gateway PCs were the only ones to do well on our Learning/usability rating in both the

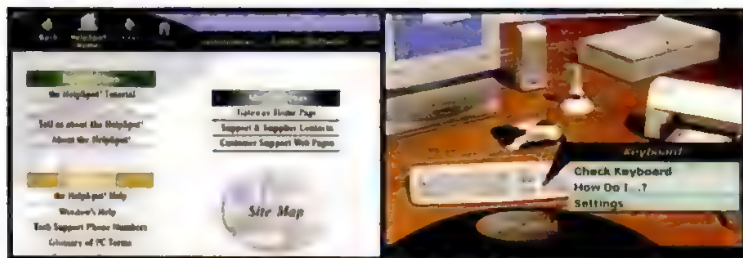
Ease-of-Use Highlights *What companies are doing right.*

▶KEYBOARD BUTTONS In order to make applications even more accessible, many vendors include extra buttons on their keyboards that you can program to launch your favorite software packages. Often there will be a specific button to launch your Internet browser and automatically dial up your chosen provider. Many vendors also include controls for the DVD or CD-ROM drive, and ready volume and mute buttons as well. (IBM Aptiva SE7, on the right.)



▲INTERNET SETUP WIZARD Several vendors have developed their own Internet setup guides to help you connect. They'll walk you through each step, from spelling out

vendors' particular offers to gathering your specific information and choosing a default connection number. (Compaq Presario 5600 Series, above.)



▲HELP/TECHNICAL INFO A number of vendors are putting most of their documentation on disk and augmenting it with instant-launch buttons to their tech-support Web sites, diagnostic and troubleshooting

tools, and multimedia tutorials that help you learn to use your system effectively. Tutorials vary from elementary descriptions of basics to step-by-step guides to upgrades. (Gateway systems, above.)

▼FRONT-PANEL PORTS Many systems come with setup conveniences such as color-coded cables, well-labeled ports, and clear setup documentation. Some companies also add thoughtful touches for daily use, such as placing oft-used and changed ports in the front of the unit instead of making you constantly reach back to hook up a USB scanner, digital camera, or digital video camera. (Compaq Presario 5600 Series, below.)



It goes about a country mile.

(City mileage may vary.)



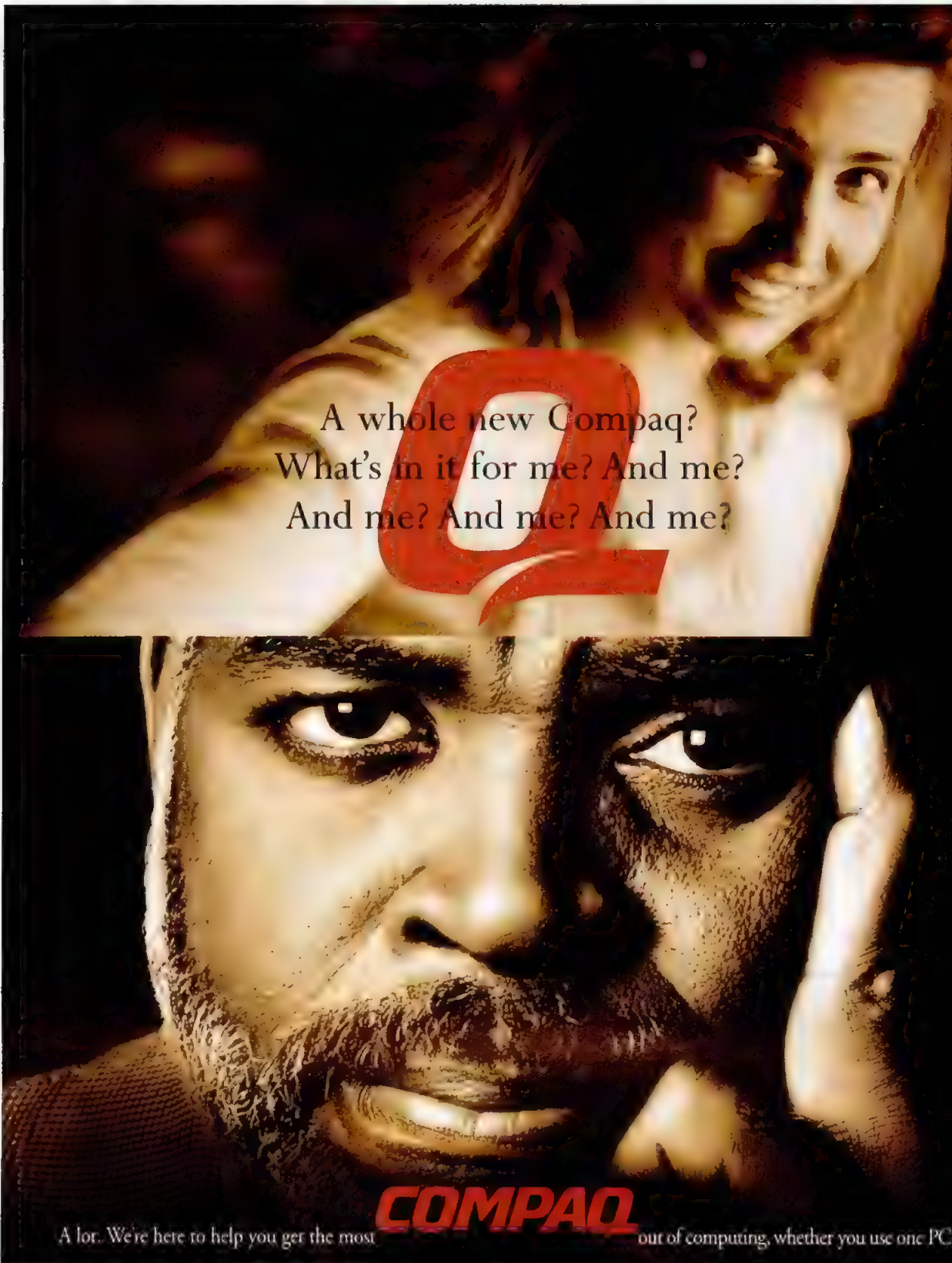
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high-end and mainstream classes.

In the area of troubleshooting and support, we found a mixed bag: Compaq, Dell, IBM, and Packard Bell are best, providing thorough troubleshooting information, and adequate warranties. A caveat: Though Packard Bell has built a new tech support facility, it has been rated low consistently on our Service and Reliability Survey.

To improve customer satisfaction—and decrease support costs—vendors need to do more to make PCs easy to use. Clear documentation specific to each system, one user's guide with well-organized subsections, as well as thorough troubleshooting information both in print and online benefit all users. First-time buyers also need well-organized tutorials that walk them through common tasks, such as setting up an Internet connection. More experienced users should have tutorials to help them with upgrades. Diagnostics programs should be included—and their interface should be easy to use and link with step-by-step instructions either to fix the problem or to help organize the information you need to tell a technical support person.

FEATURES AND PERFORMANCE MATTERS

If you want to spend about \$1,500, you have plenty of choices—you'll get a fairly large hard disk and a good CPU, such as a Celeron 333 or Pentium II/350. The best systems, such as our Editors' Choice, the Gateway G6-333C, or the Dell Dimension V333C, will also give you a DVD drive, good sound and good software. For \$2,500, you'll consistently find DVD drives, top-of-the-line CPUs (Pentium II/450), better performance, larger disks, and, often, Iomega Zip Drives, as with the Editors' Choice-winning Dell Dimension XPS R450, and the Compaq Presario 5600 Series.

On the average, the extra \$1,000 for high-end systems also buys 26 percent better performance on our Winstone 99 tests, which measure system performance on common business applications. To save \$250 to \$500, scale back to a 400-MHz Pentium II CPU, and you'll only take a slight

Editors' Choice

- Mainstream: Gateway G6-333C
- High-end: Dell Dimension XPS R450



Both of our Editors' Choice winners, the mainstream Gateway G6-333C (\$1,478 direct), and the high-end Dell Dimension XPS R450 (\$2,449 direct) offer top value for your money and are especially well suited to most home users who are repeat buyers.

The Gateway G6-333C uses the new, cached 333-MHz Celeron CPU. It comes with a 9.6GB hard disk, a 2X DVD drive, AGP graphics from ATI, and top-notch Boston Acoustics speakers. It yields good performance and gives you some terrific help through Gateway's on-disk HelpSpot, as well as in printed documentation. Its micro-tower is somewhat cramped, however.

The Dell XPS R450 combines a Pentium II/450 CPU, a 9.6GB hard disk, a 4.8X DVD drive, fast nVidia RIVA TNT-based graphics, and one of the best sound systems in this roundup. Performance was good, especially on our 3-D tests—a plus if you like to do lots of gaming. The unit's DVD drive had good playback even

while other applications were running.

If you want good ease of use and a well-rounded set of home PC features, look to the high-end Compaq Presario 5600 Series (\$2,700 street), which earns an honorable mention. The unit is a bit pricey, but it offers good performance and strong multimedia capabilities.

The Celeron/333-based Dell Dimension V333C (\$1,379 direct) also earns an honorable mention. This good performer should appeal to experienced users looking for top value. Four mainstream units are true home PCs: The HP, IBM, Packard Bell and Sony. We were unimpressed with the quality of construction of the units from HP and Sony, and Packard Bell has had repeated problems with service and reliability. That leaves the IBM Aptiva E4N (\$1,550 street) as this roundup's best option for the first-time buyer. This AMD K6-2/350-based PC is overpriced but offers fair troubleshooting help.

Both Dell and IBM earned top marks on our Service and Reliability Survey; Gateway and Compaq each had four above-average scores and one average score.

performance hit—5 to 10 percent.

2-D graphics are fast enough, but 3-D graphics are another matter. If you like to play lots of games, look for PCs like the high-end Dell and Micron systems, our roundup champs on 3-D, which use nVidia RIVA TNT-based graphics cards. 3-D scores ranged from 72 to 500; anything under 300 will probably not satisfy true gamers.

18 of the 24 PCs we tested came with a DVD drive; while most play back video well enough, a number of units, such as those from CompUSA, NEC, and Pionex,

had trouble keeping the video stream smooth while performing other tasks. The Sony units and the Micron Millennia 333 also encountered difficulties in DVD playback. Typically, hardware-assisted DVD playback is better than software-based decoding even in PCs with fast 450-MHz CPUs, but we saw no clear pattern among the systems in this roundup.

Two high-end PCs (from Compaq and Sony) had IEEE 1394 ports (FireWire). This high-speed serial connection allows faster throughput between your PC and peripherals, but little exists to take advantage of it. Today, the most common devices available are digital video and still cameras.

PCs are still not easy to use, but as you'll see in the following pages, they're better toys and tools than ever.

Our Contributors: BRUCE BROWN is a contributing editor of *PC Magazine*.

ROBERT S. ANTHONY and CADE METZ are senior writers at *PC Magazine*. MARY E.

BEHR is a staff editor of *PC Magazine*. RICH FISCO was the project leader, and ANUSH YEGYAZARIAN was the associate editor in charge of this story.

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Dell	54%	43%	49%	10%
IBM	41%	33%	36%	15%
Compaq	37%	30%	30%	17%
Average*	40%	33%	32%	16%

*Service and Reliability Survey, PC Magazine, July 1998

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Systems with better

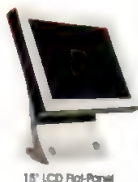


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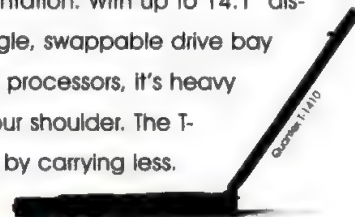
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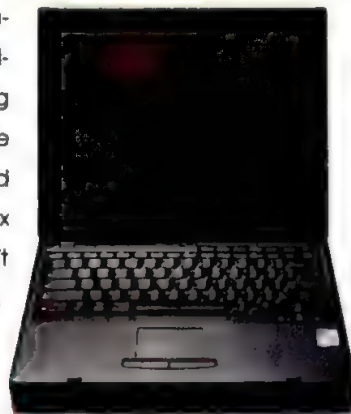
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- Add 56K V.90 Fax/Modem* for \$39

QP6/333 SB-2(w/ Pentium® II Processor).....\$1349

QP6/400 SB-2(w/ Pentium® II Processor).....\$1549

QP6/400 SB-3 \$1649

Business lease: \$58/Mo.

- Pentium® II Processor 400MHz/100MHz Front Side Bus
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor w/OSD & NEC ChromaClear CRT (16.0" viewable, 25 dp, 1600x1200 max. resolution)
- Intel740™ 3D ZK AGP Graphics with 8MB SDRAM
- New Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- Microsoft Office '97 SBE v2.0
- Upgrade to MS Office '97 Professional for \$199
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr / 7-day Technical Support
- OSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Add 56K V.90 Fax/Modem* for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$549

QP6/350 SB-3(w/ Pentium® II Processor).....\$1499

QP6/450 SB-4 \$2099

Business lease: \$74/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 18" Monitor w/ OSD (16.1" viewable), 1600x1200, 26dp
- New Ultra-Fast #9 Revolution IV 128-bit 3D ZK AGP Graphics w/32MB
- New Intel Pro 10/100 PCI Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max EIDE CD-ROM Drive
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- Microsoft Office '97 SBE v2.0
- Upgrade to MS Office '97 Professional for \$199
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr / 7-day Technical Support
- OSentry Technology (Including Intel LANDesk Client Manager V.3.1)
- Add 56K V.90 Fax/Modem* for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 SB-4(w/ Pentium® II Processor).....\$1899

BUSINESS NOTEBOOKS

Quantex T-1310 \$1999

Business lease: \$70/Mo.

- Pentium® II processor 233MHz
- Intel Mobile Module (I M M) Architecture
- New Ultra-Thin Design (12.44"x9.84"x1.37")
- 13.3" XGA Active Matrix Display
- 32MB SDRAM / 512KB Secondary Cache
- 4GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- 24X Modular CD-ROM Drive / 3.5" Modular Floppy Drive
- New NeoMagic NM65 128-bit AGP Video
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98 / Corel Office Suite 8
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

T-1310 w/Pentium II processor 233MHz.....\$2199

OPTIONS: Mini-Docking Station \$149 • 2nd Lithium Ion Battery \$129 • PCMCIA NIC \$129 • Quantex Deluxe Carrying case \$99

Quantex T-1400 \$2499

Business lease: \$88/Mo.

- Pentium® II processor 266MHz
- Intel Mobile Module (I M M) Architecture
- New Ultra-Thin Design (12.44"x9.84"x1.43")
- 14.1" XGA Active Matrix Display
- 64MB SDRAM / 512KB Secondary Cache
- 4GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- 24X Modular CD-ROM Drive / 3.5" Modular Floppy Drive
- New NeoMagic NM65 128-bit AGP Video
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- Mini-Docking Station
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98 / Microsoft Office '97 SBE v2.0
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

T-1400 w/Pentium II processor 300MHz.....\$2899

Quantex T-1410 \$2849

Business lease: \$100/Mo.

- Pentium® II processor 300MHz
- Intel Mobile Module (I M M) Architecture
- New Ultra-Thin Design (12.44"x9.84"x1.43")
- 14.1" XGA Active Matrix Display
- 80MB SDRAM / 512KB Secondary Cache
- 6GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- New ZX Modular DVD-ROM Drive / 3.5" Floppy Drive
- New NeoMagic NM65 128-bit AGP Video
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98
- Microsoft Office '97 SBE v2.0
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

Quantex T-1411 \$3099

Business lease: \$104/Mo.

- Pentium® II Processor 300MHz
- Intel Mobile Module (I M M) Architecture
- New Ultra-Thin Design (12.44"x9.84"x1.43")
- 14.1" XGA Active Matrix Display
- 96MB SDRAM / 512KB Secondary Cache
- 6GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- New ZX Modular DVD-ROM Drive / 3.5" Floppy Drive
- New NeoMagic NM65 128-bit AGP Video
- Integrated 16-bit Stereo Sound and Speakers
- Two Smart Lithium Ion Batteries
- Mini-Docking Station
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98 / Microsoft Office '97 SBE v2.0
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

Quantex I-1400 \$2299

Business lease: \$81/Mo.

- Pentium® II processor 266MHz
- Intel Mobile Module (I M M) Architecture
- 14.1" XGA Active Matrix Display
- 64MB SDRAM / 512KB Secondary Cache
- 4GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- Removable 24X CD-ROM Drive / 3.5" Floppy Drive
- New ATI Rage Ix Pro 3D AGP Video w/8MB
- New ESS 3D WaveTable Surround Sound and Speakers
- New Long-Lasting 12-Cell Smart Lithium Ion Battery
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98 / Corel Office Suite 8
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

I-1400 w/Pentium II processor 300MHz.....\$2549

Quantex I-1411 \$3399

Business lease: \$114/Mo.

- Pentium® II Processor 300MHz
- Intel Mobile Module (I M M) Architecture
- 14.1" XGA Active Matrix Display
- 128MB SDRAM / 512KB Secondary Cache
- 8GB Ultra ATA HD
- 56K V.90 Fax/Modem*
- New Removable ZX DVD-ROM Drive / 3.5" Floppy Drive
- New ATI Rage Ix Pro 3D AGP Video w/8MB
- New ESS 3D WaveTable Surround Sound and Speakers
- New Two Long-Lasting 12-Cell Smart Lithium Ion Batteries
- Mini-Docking Station
- USB and Fast IR Ports / Integrated Personal Touchpad
- MS Windows 98 / Microsoft Office '97 SBE v2.0
- Quantex Carrying Case
- 3-year limited warranty on CPU and Main Memory
- 1-year parts and labor limited warranty on all other components

I-1411 w/Pentium II processor 266MHz.....\$3199



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VALUE MULTIMEDIA

QP6/333 M-1c \$1099

Business lease: \$39/Mo.

- Intel® Celeron® Processor 333MHz
- 64MB SDRAM Memory / 128KB Secondary Cache
- 6.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 15" Digital Monitor (13.8" viewable)
- 64-Bit 3D PCI Graphics Accelerator with 4MB
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**

QP6/333 M-1c(with Pentium II processor).....\$1179

QP6/350 M-1c(with Pentium II processor).....\$1249

SOFTWARE: Corel Office Suite 8 • Internet the City • Compton's Interactive Encyclopedia • Body Works 6.0 • Amazon Trail II • MS Money '97 (pre-loaded only)

American Heritage Talking Dictionary • Dr. Solomons Find-Virus (pre-loaded only) • Compton's Reference Collection • MS Internet Explorer 4.0

MS Plus 98 McAfee VirusScan, File Cleaner, Start Menu cleaner, Compressed Folders, Deluxe CD Cleaner, MS Pictures '91 Express, Lose your marbles, Spider Solitaire, Golf 1998 kit, Desktop Theme

QP6/350 M-2x \$1449

Business lease: \$51/Mo.

- Pentium® II Processor 350MHz/100MHz Front Side Bus
- 64MB SDRAM Memory / 512KB Secondary Cache
- 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor w/OSD (15.8" viewable)
- Toshiba MPACT2 3D Media Accelerator w/8MB VRAM
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**

QP6/350 M-2x(with Pentium II processor).....\$1399

QP6/400 M-2x(with Pentium II processor).....\$1599

QP6/400 M-3x \$1699

Business lease: \$60/Mo.

- Pentium® II Processor 400MHz/100MHz Front Side Bus
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor w/OSD (15.8" viewable)
- Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
- Toshiba MPACT2 3D Media Accelerator w/8MB VRAM
- Internal 100MB Zip Drive with one cartridge
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**

QP6/350 M-3x(with Pentium II processor).....\$1549

QP6/450 M-3x(with Pentium II processor).....\$1899

QP6/450 M-4x \$2049

Business lease: \$72/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 96MB PC100 SDRAM Memory/512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel7400 3D ZK AGP Graphics with 8MB SDRAM
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**
- Add Altac-Lansing ACS-251 Subwoofer for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 M-4x(with Pentium II processor).....\$1849

POWER MULTIMEDIA

QP6/350 SM-1x \$1199

Business lease: \$53/Mo.

- Pentium® II Processor 350MHz/100MHz Front Side Bus
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor w/OSD (15.8" viewable)
- Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
- Intel7400 3D ZK AGP Graphics with 8MB SDRAM
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 98 w/Microsoft Plus 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**

QP6/400 SM-1x(with Pentium II processor).....\$1649

SOFTWARE: MS Office '97 Small Business Edition v2.0 • MS Money '97 (pre-loaded only) • Office Mate • Day Planner Pro • Power Business Plans • Form Designer Pro

• Project Manager Pro • Labels Unlimited • Compton's Reference Collection • Dr. Solomons Find-Virus (pre-loaded only) • MS Internet Explorer 4.0

MS Plus 98 McAfee VirusScan, File Cleaner, Start Menu cleaner, Compressed Folders, Deluxe CD Cleaner, MS Pictures '91 Express, Lose your marbles, Spider Solitaire, Golf 1998 kit, Desktop Theme

QP6/400 SM-2x \$1899

Business lease: \$67/Mo.

- Pentium® II Processor 400MHz/100MHz Front Side Bus
- 96MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13.5GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 21" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
- Based on award-winning Voodoo2 3D Technology
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-45 1 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 w/Microsoft Plus 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Upgrade to 15.0" LCD Flat-Panel Display for \$549

QP6/350 SM-2x(with Pentium II processor).....\$1749

QP6/450 SM-2x(with Pentium II processor).....\$2049

QP6/400 SM-3x \$2149

Business lease: \$75/Mo.

- Pentium® II Processor 400MHz/100MHz Front Side Bus
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13.5GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- New Ultra-Fast #9 Revolution IV 128-bit 3D ZK AGP Graphics w/32MB
- Internal 100MB Zip Drive with one cartridge
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-45 1 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 w/Microsoft Plus 98
- Power Software Bundle / Microsoft Office '97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/350 SM-3x(with Pentium II processor).....\$1999

QP6/450 SM-3x(with Pentium II processor).....\$2299

QP6/450 SM-4x \$2499

Business lease: \$88/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- New 16.8GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
- Based on award-winning Voodoo2 3D Technology
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- New Altac-Lansing ADA-305 Dolby 3D Surround Sound Speakers with subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 w/Microsoft Plus 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 SM-4x(with Pentium II processor).....\$2299

SUPER MULTIMEDIA

QP6/450 M-4x SE \$2199

Business lease: \$77/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13.5GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel7400 3D ZK AGP Graphics with 8MB SDRAM
- Internal 100MB Zip Drive with one cartridge
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-90 Speakers
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**
- Add Altac-Lansing ACS-251 Subwoofer for \$39
- Upgrade to 15.0" LCD Flat-Panel Display for \$399

QP6/400 M-4x SE(with Pentium II processor).....\$1999

QP6/450 SM-4x SE \$2849

Business lease: \$100/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 16.8GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 21" Monitor w/OSD (20.0" viewable), 1600x1200
- New Ultra-Fast #9 Revolution IV 128-bit 3D ZK AGP Graphics w/32MB
- Internal 100MB Zip Drive with one cartridge
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- 32X Max EIDE CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- New Altac-Lansing ADA-305 Dolby 3D Surround Sound Speakers & subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows 98 w/Microsoft Plus 98
- Power Multimedia Software Bundle
- Microsoft Office '97 SBE v2.0
- 3-year limited warranty with 1-year On-Site Service**

QP6/400 SM-4x SE(with Pentium II processor).....\$2649

M-SERIES BEST BUY

QP6/450 Best Buy \$1799

Business lease: \$70/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel7400 3D ZK AGP Graphics with 8MB SDRAM
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- Altac-Lansing ACS-45 1 Speakers w/Subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- 3-year limited warranty with 1-year On-Site Service**
- Add Altac-Lansing ACS-251 Subwoofer for \$39
- Add a Internal Zip Drive for \$79

GAMING BEST BUY

QP6/450 GX-2 \$2499

Business lease: \$88/Mo.

- Pentium® II Processor 450MHz/100MHz Front Side Bus
- 128MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13.5GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
- Intel7400 3D ZK AGP Graphics with 8MB SDRAM
- Internal 100MB Zip Drive with one cartridge
- 56K V90 PCI Fax/Modem* w/Voice Mail and Speakerphone
- New 3rd-Generation 4.8X DVD-ROM Drive
- Aureal "A3D" 3D Positional PC Sound
- 3Dfx Voodoo2 based 3D Game Accelerator w/12MB
- MS SideWinder 3D Pro Joystick
- New Altac-Lansing ADA-305 Dolby 3D Surround Sound Speakers & subwoofer
- Quantex ATX Mid Tower Case
- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98 w/Microsoft Plus 98
- Value Multimedia Software Bundle
- Action Game Titles: Battlezone, Heavy Gear
- Interstate 76 w/Nitro Pac
- 3-year limited warranty with 1-year On-Site Service**

QP6/400 GX-2(with Pentium II processor).....\$2299



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Price/Performance Index: Home PCs

Our Editors' Choice winner in the high-end category, the \$2,449 Dell Dimension XPS R450, combines a Pentium II/450 processor, a 9.6GB hard disk, a 4.8X DVD drive, fast nVidia RIVA TNT-based graphics and a top-notch sound system to give you a terrific value. Performance was good across our tests and Dell earned top marks on our Service and Reliability Survey.

PC novices will want a system with more help, such as the Compaq Presario 5600 Series (\$2,700, street). It, too, comes with a Pentium II/450, good performance and adequate multimedia. It has a 13.8GB hard disk, and a 2X DVD drive. Compaq earned four above average scores and one average score on our Service and Reliability Survey. The \$3,050 (street) IBM Aptiva SE7 also provides novice users with the help they need, and has a top-notch sound and DVD system. IBM also had top scores on our Service and Reliability Survey. The unit could not run our 3D WinMark tests, however.

Our mainstream Editors' Choice, the \$1,478 Gateway G6-333C, features the new Celeron 333 processor a 9.6GB disk, a 2X DVD drive, good Boston Acoustics speakers, and AGP graphics from ATI. It's a great bargain that gives you some good help and strong ease-of-use features, although not at the same level as those in the Compaq PC. Gateway had four above average and one average Service and Reliability scores.

If you can do without handholding, the \$1,499 MidWest Micro Multimedia Pro PRH 400 is a great value. It comes with a Pentium II/400 CPU, a 6.1GB hard disk, STB Velocity 128 AGP graphics, and a 32X CD-ROM drive.



Compaq Presario 5600 Series

Pentium II/450, 128MB SDRAM, 13.8GB disk, 17" monitor. Business Winstone 99: 22.4. \$2,700 street. 800-345-1518, 281-370-0670; www.compaq.com.

● Compaq Computer has succeeded in fashioning a relatively easy-to-use home PC with the Presario 5600 Series. With average performance, ample help, and special features, it does little to scare off PC novices. Compaq also offers sub-\$1,000 Cyrix M2- and AMD K6-based systems and mainstream Celeron/333-based home PCs (which it declined to send for this review).

The Presario is long on connectivity: Two USB ports and an IEEE 1394 (FireWire) port are behind a plastic door

on the front, and another 1394 port is on the rear. The unit also has a 56-Kbps voice modem, Intel Video Phone software, and an integrated 10/100-Mbps Ethernet port. Behind a drive-bay door is a DVD drive as well as an 100MB Iomega Zip Drive. The Presario's keyboard has a palm rest and special keys for launching programs, for CD-ROM and audio control, and for starting common online tasks. Customizing the primary Internet launch button is a bit problematic, however. Audio and video playback were good but not flawless.

Documentation is good, and the unit comes with a good bundle of preinstalled home software. Also included is local- and remote-controlled diagnostics soft-

ware and Compaq's driver update service, which checks Compaq's site automatically (in the background) while you're on the



Ratings We rate PCs in five major categories, including a new one, ease of use. For first-time users and those concerned with ease of use, we also present the three subcategories that make up the overall ease-of-use rating.

OVERALL RATINGS ►

PCs today are fast and feature-rich, and we can all comfortably look forward to their getting faster and even more loaded with features. Though vendors have made efforts, for the most part PCs have gotten only moderately easier to use. For this story, we examined ease of use in depth and arrived at an overall **ease of use** rating for each system that takes three subcategories (below) into account. We weigh ease of setup equally with troubleshooting/support, learning/usability is weighted least.

Top-rated PCs in the **multimedia** category have high 3D WinMark 99 and CD-ROM test scores and top video playback, as well as MPEG-2 support and good sound. Systems that scored well on our Business Winstone 99, 3D WinMark 99, and CD-ROM WinMark 99 tests earn **excellent** ratings on the **performance** measure.

To arrive at the **sound** ratings, we conducted informal audio tests of the systems, playing CD music as well as MIDI tracks and evaluating sound quality in general. **Excellent** systems have clear sound at a variety of sound levels and cope equally well with all types of music.

To rate **excellent** in the **service offerings** category, systems must have round-the-clock technical support, long-term warranties, and money-back guarantees. Also, vendors must pay for shipping both ways when repair is required, include on-site service standard, charge low—or better no—restocking fees, and support the software sold with the system.

	EASE OF USE	MULTIMEDIA	PERFORMANCE	SOUND	SERVICE OFFERINGS
MAINSTREAM					
CompUSA PC American Pro AP350L	Poor	Fair	Fair	Poor	Good
Dell Dimension V333C	Fair	Fair	Fair	Fair	Excellent
EDITOR'S CHOICE Gateway G6-333C	Fair	Fair	Fair	Excellent	Excellent
HP Pavilion 6350	Fair	Poor	Poor	Poor	Fair
IBM Aptiva E4N	Fair	Fair	Poor	Fair	Good
Micron Millennia 350	Poor	Fair	Fair	Poor	Excellent
MidWest Micro Multimedia Pro PRH 400	Poor	Fair	Good	Fair	Excellent
Packard Bell Platinum 7800	Fair	Fair	Poor	Poor	Fair
Pionex 6350-X	Poor	Poor	Fair	Fair	Fair
Quantex QP6/350 M-2x	Poor	Poor	Poor	Good	Excellent
Sony VAIO PCV-E204	Fair	Fair	Fair	Poor	Good
HIGH-END					
Compaq Presario 5600 Series	Good	Fair	Good	Good	Good
CompUSA PC American Pro AP450L	Poor	Excellent	Excellent	Fair	Good
EDITOR'S CHOICE Dell Dimension XPS R450	Fair	Excellent	Excellent	Excellent	Excellent
Gateway G6-450	Fair	Excellent	Excellent	Excellent	Excellent
Gateway GX450-XL	Fair	Excellent	Excellent	Excellent	Excellent
HP Pavilion 8390	Good	Fair	Good	Poor	Fair
IBM Aptiva SE7	Fair	Poor	Good	Good	Good
Micron Millennia 450 MAX	Poor	Excellent	Excellent	Excellent	Excellent
MidWest Micro Multimedia Pro PRH 450	Poor	Fair	Good	Fair	Excellent
NEC Ready 9910	Poor	Fair	Good	Fair	Fair
Pionex 6450-X	Poor	Excellent	Excellent	Good	Fair
Quantex QP6/450 M-4x SE	Poor	Excellent	Excellent	Good	Excellent
Sony VAIO PCV-E308DS	Fair	Good	Excellent	Poor	Good

	Setup	Troubleshooting/Support	Learning/Usability
MAINSTREAM			
CompUSA PC American Pro AP350L	Poor	Fair	Fair
Dell Dimension V333C	Good	Good	Poor
EDITOR'S CHOICE Gateway G6-333C	Good	Fair	Poor
HP Pavilion 6350	Fair	Fair	Good
IBM Aptiva E4N	Fair	Good	Fair
Micron Millennia 350	Poor	Fair	Poor
MidWest Micro Multimedia Pro PRH 400	Poor	Fair	Poor
Packard Bell Platinum 7800	Fair	Good	Fair
Pionex 6350-X	Poor	Fair	Poor
Quantex QP6/350 M-2x	Poor	Poor	Poor
Sony VAIO PCV-E204	Fair	Fair	Poor
HIGH-END			
Compaq Presario 5600 Series	Good	Good	Good
CompUSA PC American Pro AP450L	Fair	Poor	Fair
EDITOR'S CHOICE Dell Dimension XPS R450	Good	Good	Fair
Gateway G6-450	Fair	Fair	Good
Gateway GX450-XL	Fair	Fair	Good
HP Pavilion 8390	Good	Fair	Good
IBM Aptiva SE7	Poor	Good	Good
Micron Millennia 450 MAX	Poor	Poor	Poor
MidWest Micro Multimedia Pro PRH 450	Poor	Poor	Poor
NEC Ready 9910	Poor	Fair	Fair
Pionex 6450-X	Fair	Fair	Poor
Quantex QP6/450 M-4x SE	Poor	Poor	Poor
Sony VAIO PCV-E308DS	Fair	Fair	Poor

◀ EASE OF USE: BREAKOUT SCORES

Ease of use is not typically a priority for those who have lots of experience with PCs, but that may change once a system comes home, where inexperienced family members are likely to use it. To help both novice users and more experienced ones who are buying PCs for the home, we take an in-depth look at ease of use. PC Magazine Labs' test script has over 180 questions, organized into three categories.

Systems that earn **excellent** ratings for **setup** have, among other things, quick-start documentation, a setup troubleshooting guide, and clearly labeled ports and cables. They provide straightforward help for setting up Internet and other connectivity features, as well as easy-to-understand documentation that is system-specific.

Systems earning an **excellent** rating on our **troubleshooting/support** category have easy-to-follow—and easy-to-find—troubleshooting guides that cover all the hardware in the system, offer wizards to help diagnose problems

and test solutions, and provide system-recovery disks, among other things. These PCs will also come with remote diagnostic utilities. The vendors' Web sites should be easy to navigate and should offer complete, specific technical information, driver and software updates, and lists of options with prices. Finally, **excellent** systems in this category also have easy upgrade paths with plenty of space for accessing and adding components, along with clear documentation and step-by-step upgrade instructions.

For the **learning/usability** rating, **excellent** systems are those that provide convenient control buttons for your CD- or DVD-ROM drive, have one-touch, customizable launch buttons for applications, and provide the documentation you need to program the buttons to your specifications easily. Some vendors also provide alternative interfaces to guide you through Windows and its functions. If such an interface is flexible, intuitive, and useful, we rate it as **excellent**.

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Vendor Service and Reliability



We rate vendors for which we received at least 50 responses in our latest Service and Reliability Survey of 17,000 subscribers. We analyze the data using a *t-test*, a standard statistical procedure for identifying differences that are significant at a 95 percent confidence level. For details on our testing methodology as well as information on other desktop and notebook vendors, see page 219 of our issue of July 1998. The **satisfaction** ranking reflects respondents' experiences with **reliability**, **repair**, and **technical support** over the past two years. **Units needing repair** refers to the proportion of the desktops that the respondents said needed repair during the past year. In this category, "significantly better than average" means the incidence of needed repairs was lower than average. **Buy again?** indicates the proportion of respondents who would buy a new PC from the same vendor.

	Satisfaction with			Units needing repair over the past 12 months	Buy again?
	Reliability	Repair	Technical support		
Apple	Significantly worse than average	Average	Significantly better than average	Significantly better than average	Significantly worse than average
Compaq	Significantly better than average	Average	Significantly better than average	Significantly better than average	Significantly better than average
Dell	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average
Gateway	Significantly better than average	Significantly better than average	Significantly better than average	Average	Significantly better than average
Hewlett-Packard	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average
IBM	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average	Significantly better than average
Micron	Significantly better than average	Significantly better than average	Significantly better than average	Average	Significantly better than average
MidWest Micro	Average	Significantly better than average	Significantly better than average	Average	Average
NEC	Average	Average	Average	Average	Significantly better than average
Packard Bell	Significantly worse than average	Significantly worse than average	Significantly worse than average	Average	Significantly worse than average
Quantex	Significantly better than average	Significantly better than average	Significantly better than average	Average	Significantly better than average
Sony	Significantly better than average	Average	Significantly better than average	Significantly better than average	Significantly better than average

Web, looking for updated drivers relevant to your PC. The service can be disabled. Compaq offers a \$100 rebate if you try its Internet access service.

The unit posted average scores on most of our tests but was a below-average performer on our 3-D tests. Compaq offers a one-year warranty with 90 days of free on-site service. Technical support is available 24 hours, 7 days.—*Robert S. Anthony*

CompUSA PC American Pro AP350L, American Pro AP450L

AP350L: Pentium II/350, 64MB SDRAM, 6.4GB disk, 17" monitor. Business Winstone 99: 16.8. \$1,501. **AP450L:** Pentium II/450, 128MB SDRAM, 9.8GB disk, 19" monitor. Business Winstone 99: 22.6. \$2,548 direct. Dallas; 888-226-6772, 972-982-4000; www.compusera.com; 502 at www.pcmag.com/infolink.

● CompUSA, which lets you configure its PCs by phone or on the Web, or buy them through its CompUSA retail stores, sent us two stark but capable machines. They're not home PCs in the strictest sense, lacking color-coded cables, setup posters, and any printed documentation, but they perform reasonably well and offer some helpful documentation on CD.

Though it uses the same off-white, screw-fastened chassis as the AP350L, the high-end AP450L is slightly more imposing than its sibling, offering a DVD drive, a subwoofer, and an Iomega Zip Drive. It scored particularly well on our 3D WinMark tests, making up for a poor result under the Disk WinMark test. DVD playback was good as long as no applications were running in the background.

The AP350L is simpler and considerably less expensive. Compared with other units in our mainstream category, it performed well during CD-ROM testing and modestly on most other tests but was quite anemic during 3-D testing. We encountered a few problems while installing a USB mouse on the AP350L.

Neither PC ships with setup help or printed manuals—a drawback if your OS isn't booting. But the Device Driver and Tools CD affords easy access to CompUSA's FTP site, diagnostics utilities, drivers, hardware documentation, and technical support information. Bundled software includes Microsoft Money 98, Encarta 98, and Word 97 on the AP450L and Microsoft Home Essentials on the AP350L.

CompUSA provides a healthy warranty and round-the-clock technical support. Relatively new to selling its own PCs, CompUSA has gotten off to an admirable start, but these PCs are not geared toward inexperienced users.—*Cade Metz*



Dell Dimension V333C, Dimension XPS R450

V333C: Celeron/333, 64MB SDRAM, 6.1GB disk, 17" monitor. Business Winstone 99: 15.4. \$1,379. **XPS R450:** Pentium II/450, 128MB SDRAM, 9.6GB disk, 19" monitor. Business Winstone 99: 23.5. \$2,449 direct. Round Rock, TX; 800-388-8542; www.dell.com; 503 at www.pcmag.com/infolink.



The Editors' Choice-winning high-end PC is a terrific enthusiast's power system, combining top performance and good hardware with a great price. The mainstream unit offers an attractive package for bargain hunters but neither unit is the best bet for absolute beginners. To add value, Dell—in partnership with AT&T and Excite—has developed a new Internet portal packed with information.

The mainstream V333C offers second-time buyers who don't need the highest performance levels a lot of computing capability, including a DVD-2 drive, for an attractive price. Users seeking higher levels of productivity and performance will find the high-end XPS R450 an amply equipped entertainment and work appliance; it adds an Iomega Zip Drive, better video, and excellent audio that's among this roundup's best. Gamers, take note: Its 3-D score tied for first place with the high-end Micron PC's. DVD playback was good on both systems.

Dell can't be accused of skimping on documentation. On the contrary, the multiple manuals and addenda, plus a helpful setup chart (augmented by color-coded cables and connectors), yield all the infor-

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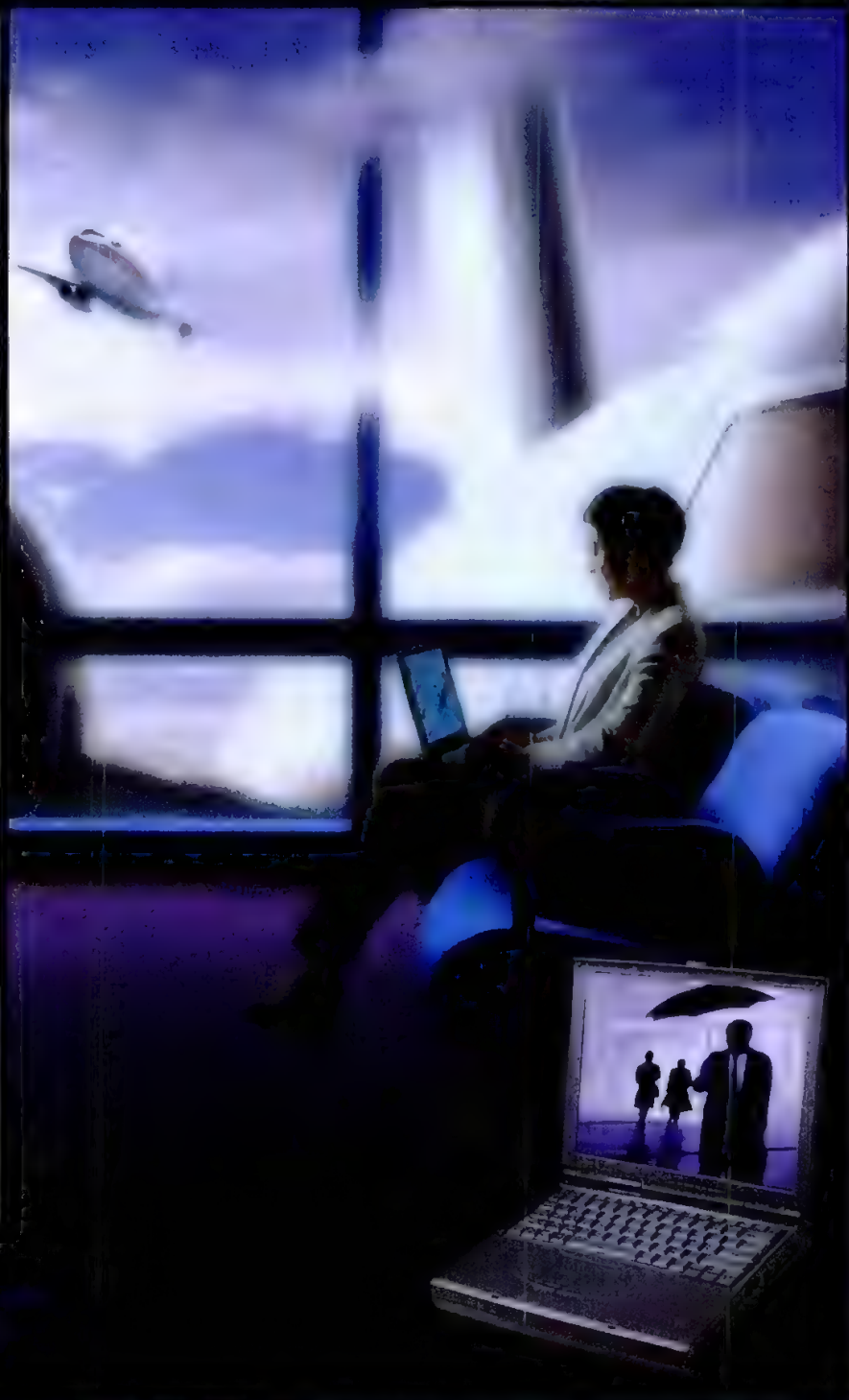
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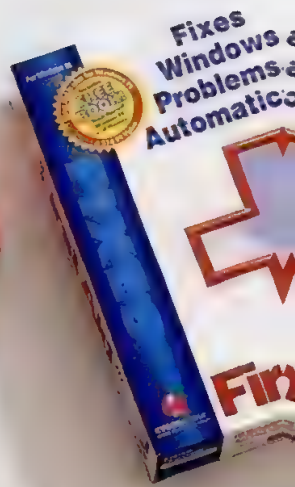
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BENCHMARK TESTS

Home PCs



If performance is a priority, look for systems with Intel's Pentium II/450, 7,200-rpm hard disks, and fast graphics cards based on the nVidia RIVA TNT chip set.

The Gateway GX450-XL, based on a Pentium II Xeon/450 CPU (typically a workstation chip), took many of the top spots on our tests, including ZD Business Winstone 99. Along with a fast CPU, the GX450-XL combined a 7,200-rpm IBM DTTA disk and top 2-D graphics from the nVidia RIVA TNT chip set to eke out the last ounce of performance. High-end PCs from Dell, Gateway (G6-450), Micron, and Quantex all combined similar IBM disks and graphic components to earn top Winstone scores as well.

The HP Pavilion 6350—the slowest PC we tested—was hampered by its AMD K6-2/333 CPU (which runs on a 66-MHz bus, unlike the K6-2/350 found in the IBM Aptiva E4N), its 4,000-rpm Quantum Bigfoot disk, and a SiS 5597-based graphics subsystem.

APPLICATION AND 3-D TESTS

High scores are best.
Bold type denotes first place within each category.
denotes Editors' Choice.

MAINSTREAM PCs

	ZD Business Winstone 99	ZD 3D WinMark 99
CompUSA PC American Pro AP350L	16.8	240*
Dell Dimension V333C (Celeron/333)	18.4	124
Gateway G6-333C (Celeron/333)	18.6	188*
HP Pavilion 6350 (AMD K6-2/333)	9.2	N/A
IBM Aptiva E4N (AMD K6-2/350)	12.6	161*
Micron Millennia 360	18.4	169
Midwest Micro Multimedia Pro PRH 400	19.0	172
Packard Bell Platinum 7000 (PII/360)	7.1	72*
Pionex 6350-X	15.5	N/A
Quantex CP6/350 M-2x	14.2	N/A
Sony VAIO PCV-E204 (PII/333)	15.6	162*

HIGH-END PCs

Compaq Presario 5600 Series (PII/450)	22.4	141
CompUSA PC American Pro AP450L	22.6	482
Dell Dimension XPS R450	23.5	500
Gateway GX450-XL (PII Xeon/450)	25.2	475
Gateway G6-450	23.5	481
HP Pavilion 6350 (PII/450)	22.1	125
IBM Aptiva SE7 (PII/450)	20.7	N/A
Micron Millennia 450 MAX	23.9	500
Midwest Micro Multimedia Pro PRH 450	21.8	141
NEC Ready 9910 (PII/450)	21.4	134
Pionex 6450-X	21.4	481
Quantex CP6/450 M-4x SE	23.4	481
Sony VAIO PCV-E308DS (PII/450)	21.9	321

N/A—Not applicable. The unit could not complete this test.

* We tested this system at 800-by-600 resolution (1,024-by-768 was our default).

BETTER ▶

As on the 2-D ZD Graphics WinMark 99 tests, the top-scoring ZD 3D WinMark PCs all used the TNT chip set. The otherwise top-scoring GX450-XL faltered a bit, coming in 5 percent behind the high-end Dell and Micron leaders. We suspect its driver was not as finely tuned as those of other PCs. DirectX 6.0 is still new, and vendors are still developing and tuning their drivers.

Top rotational speed is still the deciding factor on our ZD Business Disk WinMark 99 tests. The fastest drives were 7,200-rpm DTTA 371010 and DTTA 371440 models, both from IBM. In previous roundups, we found a disk-caching utility from Genesis One that enhanced disk performance. It doubled Disk WinMark 98 scores while showing only a small performance increase on Winstone 98. The utility took advantage of Disk WinMark 98's small memory footprint, which allowed it to use the extra memory space for caching; Winstone loads complete application suites, which gives it a large footprint. Disk WinMark 99 now models Winstone 99's memory footprint. The Genesis One utility now shows about a 20 percent boost on Disk WinMark 99 and about a 5 to 7 percent boost on Winstone 99. The high-end Dell and all three Gateway PCs used and benefited from the Genesis One utility.

Running our set of application tests, we found that the Apple PowerMac G3 outperforms the iMac previously examined by PC Magazine Labs because of its faster CPU speed (300 MHz over 233 MHz) and more powerful graphics subsystem (ATI 3D Rage Pro compared with the ATI Rage IIc in the iMac). The G3 could not top the Dell Dimension XPS R400 comparison unit on most tests.

How We Tested

We tested systems in two categories: high-end (128MB of RAM) and mainstream (64MB of RAM). Each system ran Windows 98 and had a 6GB or larger hard disk. We stripped each PC's start-up configuration of all processes or tasks except Systray, Explorer, graphics card control panels, and ActiveX controls. We defragmented the hard disk before each test and let Windows 98 manage virtual-memory settings. We installed DirectX 6.0 if it was not previously installed before running our 3D WinMark tests.

ZD Winstone 99 is divided into ZD Business Winstone 99, focusing on mainstream applications, and ZD High-End Winstone 99, which emphasizes CPU and graphics-intensive applications. ZD WinBench 99's ZD Graphics WinMark 99 and ZD

◀ The Gateway GX450-XL placed first on our ZD Business Winstone 99 test, thanks to its Pentium II Xeon/450 CPU. We suspect the Packard Bell PC has a graphics problem that led to abnormally low Winstone and 3D WinMark scores. Vendors are still having problems with the new DirectX 6.0, as evinced by the four PCs that could not complete our 3D tests.

▼ The Apple Power Macintosh G3 beat the iMac on nearly all counts. It couldn't beat the comparison PCs from Dell on most tests, however. The G3 did lead the pack on the FileMaker Pro tests. FileMaker Pro is well-optimized for the Mac OS. Our FileMaker Pro tests are also disk intensive, and with similarly performing disks in the systems, all the results were close.

APPLE VS. PC

▲ High scores are best.
▼ Low scores are best.
Bold type denotes first place.

	Ray Dream Studio 5 Render (seconds)		Adobe Photoshop 5.0 (seconds)			FileMaker Pro 4.0 (seconds)			Quake II (frames per second)		
	Animation	Still Median	Gaussian Blur	Noise Median	Lighting Effects	Import	Sort	Export	Timedemo 2	Timedemo 3	Time-refresh
Apple PowerMac G3 PowerPC (G3/300)	50	20	5	13	37	30	52	20	25.8	22.4	22.9
Dell Dimension XPS R400 (PII/400)	13	15	2	9	26	33	54	24	41.8	34.0	39.0
Apple iMac PowerPC (G3/233)	89*	29	5	17	49	39	68	27	19.0*	16.2*	16.5*
Dell Dimension V333C (Celeron/333)	16	17	3	11	30	36	76	28	26.8	22.8	26.8

* For the Ray Dream Animation and the three Quake II tests, the iMac had 6MB of SGRAM; for all other tests, it had 2MB of SGRAM.

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BENCHMARK TESTS

Disk WinMark 99 test graphics and disk subsystems under Windows. Like Winstone 99, each has a business and high-end section. We ran only the business portion of these suites.

The CPUmark₃₂ score gauges the speed of a PC's processor subsystem, which includes the CPU, L2 cache, and system RAM.

The ZD CD-ROM WinMark 99 tests gauge the performance of each machine's CD-ROM subsystem, which includes the CD-ROM drive, adapter, and required software drivers. The CD-ROM

Transfer Rate: Inside test measures the throughput of a CD-ROM subsystem reading the inside track of the CD-ROM, the minimal level of performance for the drive. The CD-ROM Access Time score measures performance as the drive randomly accesses 2K blocks from the entire CD-ROM. The CD-ROM CPU Utilization score represents the percentage of the CPU's bandwidth occupied by servicing the CD-ROM subsystem as it retrieves data.

WinBench 99 also includes a suite of video tests that measure a PC's ability to play full-motion AVI files. We tested all systems using MPEG-1 only, through ActiveMovie control. We report three results from the Full-Screen Scaling tests.

3D WinBench 99 evaluates 3-D graphics performance and assesses a system's ability to execute many of DirectX 6.0's new features. To compute 3D WinMark 99, 3D WinBench 99 displays several gamelike scenes of varying complexity and quality levels.

Apple vs. PC Application Tests

Each of the test machines had 64MB of RAM. The PCs had 8MB of video RAM; the Macs had 2MB or 6MB of video RAM. Screen resolution was set to 800-by-600, 24-bit on the PCs and 832-by-624, millions of colors on the Macs. We used all background tasks and extensions as configured by the vendors, except on the Apple G3, where we turned off AppleTalk and file-sharing extensions (we turned off virtual memory for Photoshop only). We set the disk cache on the two Apple units to 2MB and allocated each application 30MB of memory (preferred) except for Photoshop, where we set disk cache to 1MB and allocated 40MB of memory.

For FileMaker Pro 4.0 we imported a 52MB CSV data set, converted it to FileMaker Pro format, sorted the file, and exported the sorted database to WKS format. For Adobe Photoshop 5.0 we applied the lighting effects and noise median filters to a 10MB image. For Quake II we ran the built-in Timedemo 2, Timedemo 3, and Timerefresh tests. For Ray Dream Studio 5 Renderer we rendered a sample file using wireframe animation and still frame.

ZD WINBENCH 99			
High scores are best.			
Bold type denotes first place within each category.			
■ denotes Editors' Choice.			
MAINSTREAM PCs			
CompUSA PC American Pro AP350L	79	1,830	864
Dell Dimension V333C (Celeron/333)	69	2,260	673
Gateway G6-333C (Celeron/333)	71	2,580	648
HP Pavilion 6350 (AMD K6-2/333)	28	1,350	565
IBM Aptiva E4N (AMD K6-2/350)	76	1,440	827
Micron Millennia 350	73	2,940	870
Midwest Micro Multimedia Pro PRH 400	85	2,600	995
Packard Bell Platinum 7800 (PII/350)	8	2,100	894
Plonex 6350-X	57	1,970	871
Quantex QP6/350 M-2x	35	1,920	874
Sony VAIO PCV-E204 (PII/333)	72	2,010	831
HIGH-END PCs			
Compaq Presario 5600 Series (PII/450)	120	2,980	1,090
CompUSA PC American Pro AP450L	158	2,320	1,080
■ Dell Dimension XPS R450	174	3,570	1,100
Gateway GX450-XL (PII Xeon/450)	180	3,600	1,220
Gateway G6-450	167	2,460	1,110
HP Pavilion 8390 (PII/450)	111	2,680	1,100
IBM Aptiva SE7 (PII/450)	81	2,490	1,090
Micron Millennia 450 MAX	175	3,170	1,110
Midwest Micro Multimedia Pro PRH 450	100	2,820	1,100
NEC Ready 9910 (PII/450)	93	2,890	1,110
Plonex 6450-X	166	1,790	1,090
Quantex QP6/450 M-4x SE	167	2,860	1,090
Sony VAIO PCV-E308DS (PII/450)	134	2,150	1,090

▲ As expected, the Gateway GX450-XL aced our WinBench 99 tests. The HP Pavilion 6350, which came with an AMD K6-2/333, earned the lowest score on CPUmark₃₂; the AMD K6-2/350 CPU in the IBM Aptiva E4N did relatively well, however, mostly keeping pace with Pentium II/350s. The 7,200-rpm drives and the Genesis One disk-caching utility vaulted the GX450-XL to first place and the Dell Dimension XPS R450 to second place on our Disk WinMark 99 test.

► The Pioneer DR-A14S CD-ROM drive in the mainstream Midwest Micro was the fastest CD drive here. PCs with DVD drives trailed, but the gap is no longer wide. Only the mainstream Plonex dropped a significant number of frames on our video tests, most likely because of its Cirrus Logic graphics chip set.

MULTIMEDIA TESTS

▲ High scores are best. ▼ Low scores are best.		ZD CD-ROM		Transfer Rate:		Full Screen Scaling*		
Bold type denotes first place within each category.		WinMark 99	Inside	Access	CPU	Maximum	Frames	CPU
■ denotes Editors' Choice		(thousands of bytes/sec) ▲	(thousands of bytes/sec) ▲	Time (ms) ▼	Utilization (percent) ▼	Frame Rate (frames/sec) ▲	Dropped ▼	Utilization (percent) ▼
MAINSTREAM PCs								
CompUSA PC American Pro AP350L	1,400	2,760	90	4	50.1	0	31	
Dell Dimension V333C (Celeron/333)	1,400	2,350	96	4	84.3	0	35	
■ Gateway G6-333C (Celeron/333)	978	1,590	116	3	83.5	0	40	
HP Pavilion 6350 (AMD K6-2/333)	1,120	1,650	103	7	78.3	2	80	
IBM Aptiva E4N (AMD K6-2/350)	1,250	1,990	101	4	59.0	0	49	
Micron Millennia 350	688	2,390	98	4	104.0	1	40	
Midwest Micro Multimedia Pro PRH 400	1,520	2,480	84	3	34.9	0	88	
Packard Bell Platinum 7800 (PII/350)	1,440	2,170	85	7	84.4	0	31	
Plonex M6350-X	1,350	2,340	83	4	23.2	109	97	
Quantex QP6/350 M-2x	1,410	2,310	97	4	36.9	0	34	
Sony VAIO PCV-E204 (PII/333)	890	1,720	101	4	73.8	0	37	
HIGH-END PCs								
Compaq Presario 5600 Series (PII/450)	851	1,440	139	3	83.8	0	24	
CompUSA PC American Pro AP450L	786	1,450	135	4	73.7	0	48	
■ Dell Dimension XPS R450	1,430	2,290	95	4	60.8	0	25	
Gateway GX450-XL (PII Xeon/450)	1,080	2,290	94	3	50.1	0	25	
Gateway G6-450	1,440	2,300	96	3	49.4	0	26	
HP Pavilion 8390 (PII/450)	863	1,440	139	3	83.9	0	26	
IBM Aptiva SE7 (PII/450)	859	1,450	150	5	74.6	0	27	
Micron Millennia 450 MAX	781	1,450	137	4	49.7	0	26	
Midwest Micro Multimedia Pro PRH 450	1,440	2,310	98	3	74.3	0	25	
NEC Ready 9910 (PII/450)	877	1,440	133	3	73.9	0	32	
Plonex M6450-X	1,130	1,660	102	3	49.1	0	26	
Quantex QP6/450 M-4x SE	1,310	2,280	96	3	49.1	0	26	
Sony VAIO PCV-E308DS (PII/450)	856	1,720	93	4	74.2	0	26	

* With an Action, MPEG-1, 352-by-240, 30-fps, 300-Kbps clip

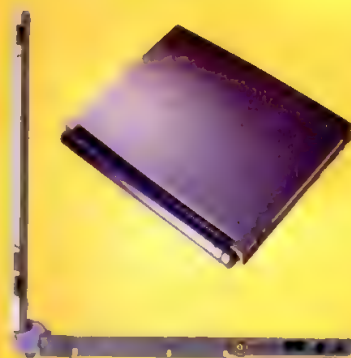
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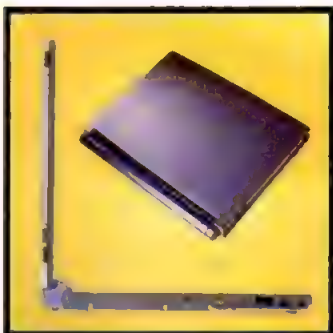


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Model: ICD-70PC

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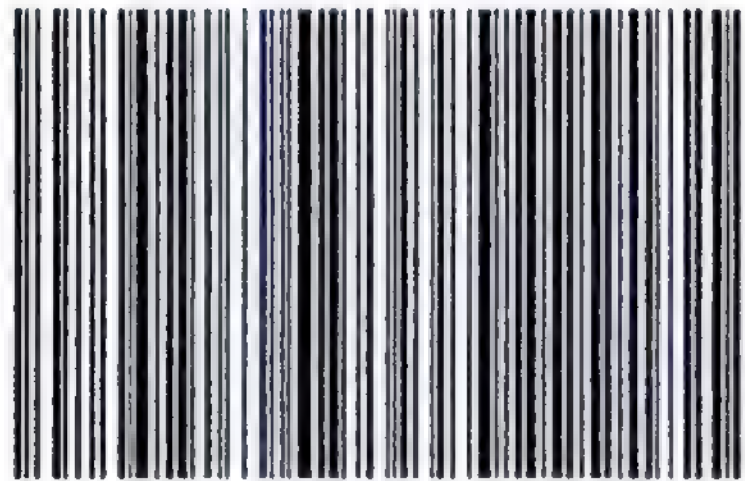
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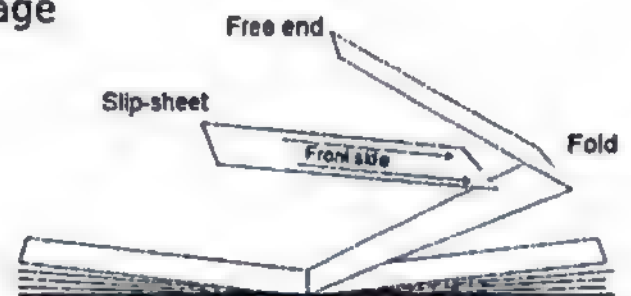
Inverted Foldout slip-sheet



GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page

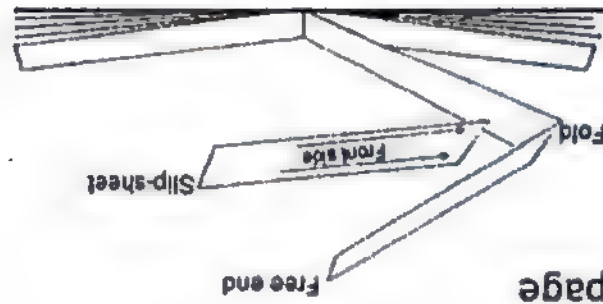
2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

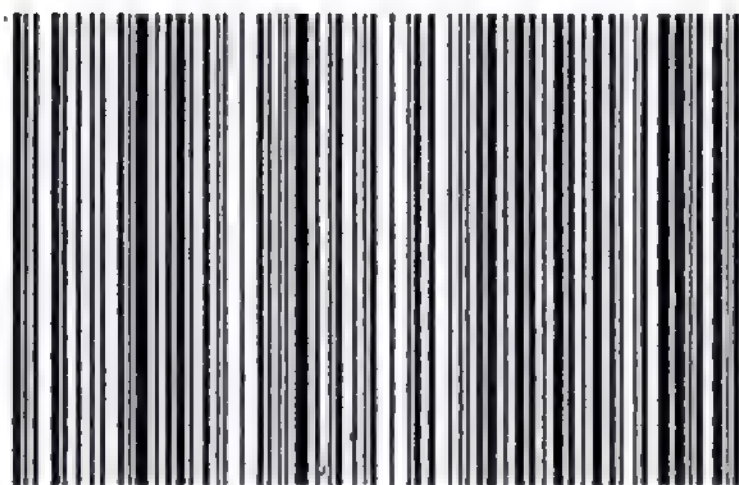
3. Slice the folded edge

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Back

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SNY 251

Apple in the Home: The iMac and Power Macintosh G3



iMac: PowerPC G3/233, 32MB SDRAM, 4GB disk, 24X CD-ROM, 15" built-in monitor. \$1,299.

G3: PowerPC G3/300, 64MB SDRAM, 8GB disk, 24X CD-ROM, 17" monitor. \$3,800 direct.

Cupertino, CA; 800-538-9696, 408-996-1010;

www.apple.com; 514 at www.pcmag.com/infolink.

Apple Computer offers two powerful units: the iMac, good for novices who don't plan to upgrade, and the Power Macintosh G3, appropriate for enthusiast buyers willing to pay the price.

Apple recently completed its first profitable fiscal year since 1995, and has attributed its success to the iMac, a mischievous-looking, home-oriented all-in-one unit. With its gentle curves and excellent online and paper documentation, the iMac is certainly at home in the home; but its integrated 10/100-Mbps Ethernet and easy-to-use network-setup wizards qualify it as a functional office client as well.

The iMac sets up in minutes: Connect three basic cords, and, optionally, modem and Ethernet cords and the unit is ready. A front-mounted 4-Mbps IrDA port, two speakers, two front-mounted headphone jacks and a microphone are above its display. All audio and monitor

controls are handled via software. The iMac can be upgraded to 128MB of SDRAM and 6MB of graphics memory, but the task of opening and closing the unit can kill an afternoon. Navigating the cramped interior is best left to professionals or experienced users.

The keyboard includes two USB ports (one for the mouse). A recently issued software update improves the iMac's compatibility with third-party USB de-



iMac and Power Macintosh G3

vices. Apple has responded to the iMac's most glaring shortcomings—lack of a floppy disk drive and limited direct-connect printer options—by adding two new iMac configurations: a \$1,448 package with an Imation SuperDisk 1.44/120MB external floppy disk drive and a \$1,696 bundle with the Imation drive and an HP DeskJet 695C inkjet printer with cables for the iMac.

The G3 has a more familiar, easy-to-open mid-tower case. Once open, half of the internal chassis swivels aside to provide clear access to the motherboard. Instead of USB ports, the G3 has just about everything else: S-Video, composite video and audio in/out ports; and modem, printer/LocalTalk network, SCSI, and 10/100-Mbps Ethernet ports. G3s come in standard configurations and can be customized on

Apple's Web site.

How do these units compare to Pentium II-based PCs? We created several application tests and compared the results with a Pentium II/400-based unit as well as a Celeron/333-based PC. We found that the 400-MHz unit was the clear winner under three of four applications (see the chart in our benchmark test section). The G3 led in the FileMaker Pro 4.0 tests while the iMac consistently trailed all others.

Both Apples came to us with Mac OS 8.1 but now ship with Mac OS 8.5, which adds several new features, including Sherlock, a natural-language search engine that can search files inside the unit as well as on the Internet. Apple provides a one-year warranty, and technical support 9:00 A.M. to 9:00 P.M. eastern time, 7 days.—Robert S. Anthony

mation needed—and then some—for installation, setup, troubleshooting, and upgrading. A single manual would actually be an improvement, because in some cases

finding the relevant data requires flipping through multiple documents. Information on the hard disk is easy to navigate and has references specific to each system's configuration. The new Web portal—called ConnectDirect (www.dell.excite.com)—is a convenient place to go for news, weather, and Dell-related information, including links to support services. The software bundle includes Microsoft Encarta 98, Money 98, and your choice of Home Essentials or Works Suite 99.

In addition to Dell's specific PC offerings, the company is also making deals with both ADSL and cable modem service providers to make it simpler for Dell PC owners to arrange for high-bandwidth Internet access in areas where the technologies are available.—Bruce Brown

Gateway G6-333C, G6-450, GX450-XL

G6-333C: Celeron/333, 64MB SDRAM, 9.6GB disk, 17" monitor. Winstone: 16.6. \$1,478. **G6-450:** Pentium II/450, 128MB SDRAM, 13.8GB disk, 17" monitor. Winstone: 23.5. \$2,624. **GX450-XL:** Pentium II Xeon/450, 128MB SDRAM, 13.8GB disk, 19" monitor. Winstone: 25.2. \$3,999 direct. N. Sioux City, SD; 800-846-2000, 605-232-2000; www.gateway.com; 504 at www.pcmag.com/infolink.



Gateway has packed these systems with excellent hardware and some good help for novices, especially through its HelpSpot. The G6-333C earned an Editors' Choice for its overall value, ably fulfilling the needs of repeat and first-time buyers.

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E-3100 Series	\$241.96	\$119.96	\$59.99
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G5-166, -200	N/A	\$139.96	\$69.99
G6-150, G6-200	\$219.96	\$109.96	\$59.96
G6-233 Best Buy and G6-233 Home Essentials	\$241.96	\$119.96	\$59.99
G6-266, G6-233	\$241.96	\$119.96	\$59.99
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Pavilion 7050, 7055, 7070, 7090	\$219.96	\$109.96	\$59.96
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Pavilion 8160, 8140, 8130	\$219.96	\$109.96	\$59.96
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Pavilion 8190, 8240, 8246, 8280, 8275, 8260	\$241.96	\$119.96	\$59.99
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Vectra VL 5/xxx MT Series 4 PC	\$219.96	\$109.96	\$59.96
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Performa 6200, 6300	N/A	\$109.96	\$59.96
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Power Mac 6100 Series	N/A	\$109.96	\$59.96
Power Mac 7100, 8100 Series	\$219.96	\$109.96	\$59.96
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	128MB Upgrades	64MB Upgrades	32MB Upgrades
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HelpSpot, Gateway's help CD. Developed with CyberMedia, HelpSpot ships with all Gateway home PCs. It contains information on system parts, tutorials, Backtrack (which preserves past system settings), First Aid (a guide to troubleshooting), and Oil Change—and can take you to Gateway's service and support Web site.

Setup, system, and troubleshooting information was fairly comprehensive but would have been better centralized in one location instead of scattered among three books. The Web site, while similarly comprehensive, was also a bit tricky to navigate. On disk documentation is normally standard, but the two high-end systems arrived to us without system manuals installed.

All three PCs came with special keyboards with buttons for CD controls as well as sleep, volume, and user-programmable functions. (The GX450-XL's keyboard featured buttons for Internet access as well.)

The mainstream G6-333C was mostly an average performer; it excelled on our disk test but lagged on our CPU test. Its micro-tower case complicates upgrades and limits expansion.

The high-end G6-450 is housed in a bigger, more accessible case. While most of its scores were average, it scored above average on our 3-D and 2-D graphics tests. The high-end GX450-XL, based on Intel's monstrosity large Pentium II Xeon chip (meant primarily for workstations), was, as expected, an above-average performer. One of very few Xeon-based systems targeted toward the home, its large tower case is neat and spacious, with plenty of resources for expansion and upgrading.

Attaching a power USB device was a bit of a problem for all three: The units had no preinstalled drivers. DVD playback, while good on its own, was uneven and choppy

when we ran another application at the same time. The systems have great audio from the Boston Acoustics speaker sets. The Xeon-based PC's speakers offer full five-part surround sound.—*Mary E. Behr*

HP Pavilion 6350, 8390

6350: AMD K6-2/333, 64MB SDRAM, 7.7GB disk, 15" monitor. Business Winstone 99: 9.2. \$1,300. **8390:** Pentium II/450, 128MB SDRAM, 9.8GB disk, 17" monitor. Business Winstone 99: 22.1. \$2,800 street. Palo Alto, CA; 800-724-6631; www.hp.com; 505 at www.pcmag.com/infolink.

● The mainstream 6350 is attractively priced but performed poorly. It's better left with the case closed: Upgrading is troublesome. The high-end 8390, on the other hand, has ample expansion space and is a better-performing machine. First-time users will like the helpful setup poster but will be disappointed by the relatively superficial paper documentation.

We found several expansion problems with the 6350. To add expansion cards, you must first break off bracket tabs; this proved very difficult and resulted in a slightly bent case. A standard PCI graphics adapter doesn't fit in the PCI slot. To add memory or even see the memory slots, you must push the drive cage forward; repeated efforts could not budge the cage, however. Even experienced users should think twice about upgrading this system.

The 8390—which has the same break-off bracket tabs—has more space for add-on cards, which do fit. The memory slots are easily accessible. The 8390 has a conveniently located nine-pin serial port on the front of the PC case for connecting a digital camera or hand-held PC. Each Pavilion also has a keyboard with an Internet access button and programmable keys; the high-end PC's keyboard also boasts a large, easy-to-use volume control.

HP and GTE offer 50 hours of free Internet access without having you enter a credit card number, which is laudable. Once you're connected an HP message board facilitates sharing multimedia communications.

The 6350's test scores were low—partly because the system's AMD CPU competed against a number of Pentium IIs and partly because of the slower SiS 5598 graphics chip set. Neither unit did well on our 2-D and 3-D graphics tests. The 8390's 2X DVD afforded good playback.



HP doesn't offer toll-free technical support, but help is available around the clock. And if you have to wait more than 3 minutes, the company gives you a 15-minute prepaid phone card.—*BB*

IBM Aptiva E4N, SE7

E4N: AMD K6-2/350, 64MB SDRAM, 7.7GB disk, 15" monitor. Business Winstone 99: 12.6. \$1,550. **SE7:** Pentium II/450, 128MB SDRAM, 16.1GB disk, 19" monitor. Business Winstone 99: 20.7. \$3,050 street. Research Triangle Park, NC; 800-426-7235, 919-517-2430; www.pc.ibm.com; 506 at www.pcmag.com/infolink.

● IBM's line of Aptiva home PCs, sold directly by IBM and through retail outlets, strikes a fair balance between ease of use and adept multimedia computing, but is priced above average. The Aptiva SE7—a beautiful machine providing good sound and clear video—is undeniably a market leader. The less expensive Aptiva E4N is slightly less potent, generally performing at a below-average clip on our tests, but it's still a fairly easily configured and maintained home PC.

The ebony-black SE7, \$3,050 with a brilliant 19-inch IBM monitor or \$3,500 with a 15-inch flat-panel display, provides an agile DVD implementation as well as one of this roundup's better audio subsystems (complete with speakers and, optionally, a \$100 subwoofer). A matching black Rapid Access Keyboard is outfitted with a series of buttons—programmable via software—that let you launch often-used applications and independently play CDs or DVD movies. ViaVoice, IBM's speech recognition program, is also included. The system's graphics scores were low, but most of its other results were comparable to those of its high-end competitors. It also had Direct-





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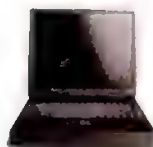
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Hard Drive	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*	3.2GB hard drive (removable)*
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DVD/CD-ROM	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	DVD-ROM drive (dedicated bay)
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Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft® Windows® 98 System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™™ Norton AntiVirus
Also Includes:	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible WaveTable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports
Price	\$1,799 \$63/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,299 \$80/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,599 \$91/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,999 \$105/mo. TechRefresh Bus. Lease, 36 mos.**

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Micron™ notebooks are among the very best available. Our notebooks have been critically acclaimed by industry pundits and power users alike. And the TransPort TREK² is no exception. Call Micron today and order any of our award-winning notebooks custom configured to meet your specific needs.



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Planes that cost millions of dollars have "mechanical

failure." Two airport hotdogs is too many. I played 18

holes between spreadsheets. I wonder where they're all

going? When you say it over and over again, "delay" starts

to sound funny. Lying down would be good. Three dollars.

M

VOL. 9 SEC. 03
pg. 12

DELAYED



**"FOR STANDING UP TO THE VAGARIES OF TRAVEL,
THE MICRON GOBOOK IS THE BEST BET GOING."**

CNET "EDITORS' CHOICE" BEST ULTRAPORTABLE REVIEWED, MAY '98

GOBOOK²



New Rules. New Tools.

You don't get to recharge your batteries every four hours. You don't get to rest whenever you feel like it. Why should your notebook? Life on the road is no cake walk and your notebook should be designed to endure the rigors of mobile life as well as you do. Introducing the GoBook notebook. With a revolutionary modular battery design, lightning-fast performance featuring the fastest Intel® Pentium® II processors, and an incredibly thin and light package, it's the ultimate companion for those who stop at nothing to succeed. And with its new, innovative Wedge Battery, the GoBook offers even more flexibility for extended battery life, even when the media bay is in use. In addition to longer life and lower weight, the new Wedge battery is also designed to provide a 9° ergonomic tilt to the keyboard and entire machine allowing for more comfortable use. It's no wonder that CNET awarded the GoBook Editors' Choice for best UltraPortable on the market, saying, "For standing up to the vagaries of travel, the Micron GoBook is the best bet going."

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A non-refundable up-front freight charge applies for participation in PowerExchange to cover cost of return packaging and processing.

is a lot for water. Solitaire is actually pretty fun for about a

minute. That person looks like somebody I know. I'm actually

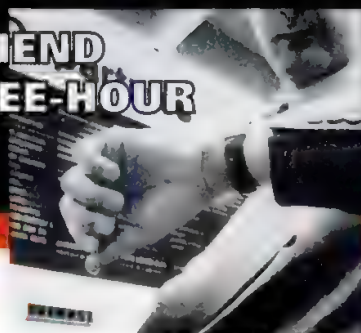
excited about the prospect of getting on a plane. Why isn't my

cell phone working? That kid keeps staring at my GoBook. This

is better than being in the office. I guess. What's that smell?



YOUR ONLY FRIEND DURING A THREE-HOUR LAYOVER



"It's not enough to be easy. The question is: What are we easy about?"

—Henry David Thoreau

"The GoBook outperformed every other machine in our review by a sizable margin" CNET, Editors' Choice, Best UltraPortable Reviewed, May '98



Here's the GoBook difference: Featuring the fastest Intel Pentium and Pentium II processors

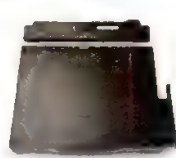
• Preloaded with Microsoft's Windows 98 • Includes a big active matrix 12.1" SVGA display powered by 128-bit graphics accelerator • A revolutionary modular battery design that performs as well traveling

across town as it does across the Atlantic Ocean • New lighter, long-life, Wedge Battery included • Big room for expandability: The GoBook includes both a 24X CD-ROM drive and a 3.5" floppy drive • All in a super thin and light package that starts at just 1.35" thin and 4.4lbs.*

Micron's Award-Winning GoBook Now Starts at Just \$1,799



GoBook™ 233



GoBook² 266



New! GoBook² 300

Model Name	GoBook™ 233	GoBook ² 266	New! GoBook ² 300
Processor	Intel® Pentium® processor with MMX™ technology 233MHz	Intel Pentium II processor 266MHz	Intel Pentium II processor 300MHz
Cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache
RAM	64MB EDO DRAM	32MB EDO DRAM	32MB EDO DRAM
Hard Drive	3.2GB hard drive*	3.2GB hard drive*	3.2GB hard drive*
Monitor	12.1" SVGA display	12.1" SVGA display	12.1" SVGA display
CD-ROM	24X CD-ROM drive	24X CD-ROM drive	24X modular CD-ROM drive
Graphics	2MB/128-bit graphics accelerator	2MB/128-bit graphics accelerator	2MB/128-bit graphics accelerator
Sound System	16-bit stereo/Wavetable sound	16-bit stereo/Wavetable sound	16-bit stereo/Wavetable sound
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft® Windows® 98 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 System Wizard Mobile Client™ Norton AntiVirus
Also Includes:	GoBook Wedge battery 4.4lbs (w/floppy drive)* 6.7lbs (w/opt./base battery & floppy) USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports MPEG compatible CardBus/Zoomed Video ready Microphone, stereo line-in/out jacks 2 Type II/1 Type III PCMCIA slots 2-way infrared port Touchpad pointing device 3.5" modular floppy drive • Add SuperBase Battery for \$299	GoBook Wedge battery 4.4lbs (w/floppy drive)* 6.7lbs (w/opt./base battery & floppy) USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports MPEG compatible CardBus/Zoomed Video ready Microphone, stereo line-in/out jacks 2 Type II/1 Type III PCMCIA slots 2-way infrared port Touchpad pointing device 3.5" modular floppy drive • Add SuperBase Battery for \$299	GoBook Wedge battery 4.4lbs (w/floppy drive)* 6.7lbs (w/opt./base battery & floppy) USB, parallel, serial, VGA, PS/2, NTSC/S-Video ports MPEG compatible CardBus/Zoomed Video ready Microphone, stereo line-in/out jacks 2 Type II/1 Type III PCMCIA slots 2-way infrared port Touchpad pointing device 3.5" modular floppy drive • Add SuperBase Battery for \$299
Price	\$1,799 \$63/mo. TechRefresh Bus. Lease, 36 mos.** <i>New Low Price!</i>	\$1,999 \$70/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,899 \$101/mo. TechRefresh Bus. Lease, 36 mos.**



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Faster...Faster...Faster...

1 Clocking at speeds over 500MHz, the cheetah is the fastest land animal. This "big cat" hunts mainly gazelle, but the average chase lasts only about 20 seconds.

2 In early October 1998, PC World Magazine ranks the Micron Millennia the #1 Power Desktop on the market calling it "the fastest of all" systems tested.

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Micron Systems:
Over 100,000 deployed Micron desktops, notebooks & servers

Favorite Feature:
Price/power ratio

Purpose:
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Tim Willits
Lead Map Designer, Id Software
Creators of Quake & Quake II



Micron Systems:
Micron Millennia 400 desktops

Favorite Feature:
400MHz - Of course

Purpose:
Test mind-bending levels of Quake II and help create one of the coolest games ever

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www.micronpc.com

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450MHz at \$1699

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- Upgrade to Monsoon 3-piece flat panel speakers w/subwoofer \$179

Featuring Intel's Fastest Processor Ever

Just named #1 450MHz desktop by the editors of CNET and #1 Power Desktop by the editors of PC World Magazine (Millennia 400 DVD • October '98, Millennia MAX 450 • PC World "Best Buy" November '98),

Micron's Millennia desktop product line continues a long tradition of industry-leading, award-winning performance. Perhaps that's why some of the most prominent power users around rely on Micron. No matter how strenuous your demands, no matter how colossal the task, we invite you to put a Millennia® desktop to the test. You'll be hard-pressed to find a Pentium® II processor based system as powerful and affordable as the Micron™ Millennia. And Micron's revolutionary new MPower™ purchase program makes Millennia ownership even easier, offering qualified users no interestSM or payments for six months as well as PowerXchange™ trade-in options on your current Pentium processor-class PC towards a new Millennia desktop.



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3 The fastest typist in the world types 170 words per minute. To give you some idea of how many words that is, this little blurb is only 30 words long.

4 The newest Micron Millennia features the Intel Pentium II processor 450MHz, the fastest chip available. Don't settle for anything less.

THERE IS NO KNOWLEDGE THAT IS NOT POWER.

— RALPH WALDO EMERSON

12
HOUR A DAY
12 MINUTES

Now important is a 15% performance difference? Think of it as 1 hour and 12 minutes in an 8-hour day.

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The Micron Difference: Rock-Solid Reliability. MPower™ and PowerXchange™ Programs. Industry-Leading Service and Support.

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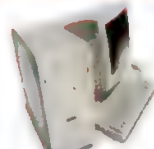
support you can count on — and that's exactly what Micron's new MPower program is all about. Call today for details or visit www.micronpc.com/pcmag.



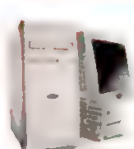
Award-Winning Complete Internet-Ready* 450MHz Systems Starting at Just \$1,699



Model Name **Millennia C333**



Millennia 350



Millennia 450



Millennia 450 MAX



Millennia 450 MAX

Model Name	Millennia C333	Millennia 350	Millennia 450	Millennia 450 MAX	Millennia 450 MAX
Processor	Intel® Celeron® processor 333MHz	Intel Pentium® II processor 350MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz
Cache	100KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache	512KB Internal L2 cache
RAM	128MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.4GB Ultra ATA hard drive*	8.4GB Ultra ATA hard drive*	8.4GB Ultra ATA hard drive*	13.6GB 7200 RPM Ultra ATA hard drive*	13.6GB 7200 RPM Ultra ATA hard drive*
Monitor	18" Micron 700Hz monitor (15.5" display)	17" Micron 700Hz monitor (15.5" display)	17" Micron 700Hz monitor (15.5" display)	17" Micron 700Hz monitor (15.5" display)	19" Micron 90Hz monitor (16" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	48X DVD 1X BD-ROM drive
Modem	3Com/US Robotics 56K WinModem**	3Com/US Robotics 56K WinModem**	3Com/US Robotics 56K WinModem**	3Com/US Robotics 56K WinModem**	3Com/US Robotics 56K WinModem**
Graphics	ATI Radeon 7500 32MB SDRAM 3D AGP graphics	ATI Radeon 7500 32MB SDRAM 3D AGP graphics	ATI Radeon 7500 32MB SDRAM 3D AGP graphics	ATI Radeon 7500 32MB SDRAM 3D AGP graphics	ATI Radeon 7500 32MB SDRAM 3D AGP graphics
Sound System	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound	PCI 64-voice WaveTable sound
Warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty

Software Included	Microsoft® Windows® 98 Microsoft® Home Essentials Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus	Microsoft Windows 98 Microsoft Office 97 Small Business Edition Microsoft Outlook Microsoft Internet Explorer Norton AntiVirus
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Also Includes:	New Microware™ case Advent A4000 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse® 3.5" floppy drive	New Microware case Advent A4000 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New Microware case Advent A4000 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New Microware case Advent A4000 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive	New Microware case Advent A4000 stereo speakers 104-key enhanced keyboard Microsoft IntelliMouse 3.5" floppy drive
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Price	\$1,249 \$44/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,499 \$52/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,699 \$59/mo. TechRefresh Bus. Lease, 36 mos.** <i>New Low Price</i>	\$2,499 \$87/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,899 \$101/mo. TechRefresh Bus. Lease, 36 mos.** <i>New Low Price!</i>
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Upgrade to:	Upgrade to: 64MB SDRAM memory 8.4GB Ultra ATA hard drive 17" Micron 700Hz monitor (15.5" display) 128MB Image Zip drive	Upgrade to: 128MB SDRAM memory 13.6GB Ultra ATA hard drive 17" Micron 700Hz monitor (15.5" display) 128MB Image Zip drive	Upgrade to: 128MB SDRAM memory 13.6GB Ultra ATA hard drive 19" Micron 90Hz monitor (16" display) 48X DVD 1X BD-ROM drive	Upgrade to: 128MB Image Zip drive Pentium MMX100 Flat panel speakers w/subwoofer 18" Micron 700Hz monitor (15" display)	Upgrade to: 256MB 100MHz SDRAM Microsoft Natural Keyboard Elite
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Price	\$1,545 \$54/mo. TechRefresh Bus. Lease, 36 mos.**	\$1,932 \$68/mo. TechRefresh Bus. Lease, 36 mos.**	\$2,232 \$78/mo. TechRefresh Bus. Lease, 36 mos.** <i>New Low Price!</i>	\$2,866 \$100/mo. TechRefresh Bus. Lease, 36 mos.**	\$3,214 \$112/mo. TechRefresh Bus. Lease, 36 mos.** <i>New Low Price!</i>
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*Optional with Micron Home Service. Processor upgrades, internal processor upgrades, motherboard, RAM and hard drive upgrades.

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SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Continues

Home PCs

■ YES ■ NO

Products listed in review order.

	Compaq Presario 5000 Series	CompUSA PC American Pro AP350L	CompUSA PC American Pro AP450L	Dell Dimension V333C	Dell Dimension XPS R490	Gateway 66-333C	Gateway 66-490	Gateway 6X450-XL
Price of tested configuration	\$2,700 street	\$1,501 direct	\$2,548 direct	\$1,379 direct	\$2,449 direct	\$1,478 direct	\$2,624 direct	\$3,999 direct
Category	High-end	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end	High-end
Processor	Pentium II/450	Pentium II/350	Pentium II/450	Celeron/333	Pentium II/450	Celeron/333	Pentium II/450	Pentium II Xeon/450
Installed/maximum SDRAM (MB)	128 / 384	64 / 384	128 / 384	64 / 384	128 / 384	64 / 512	128 / 384	128 / 512
Installed L2 pipelined-burst cache	512K	512K	512K	128K	512K	128K	512K	512K
Motherboard manufacturer	Compaq	BCM	BCM	Dell	Dell	Intel	Intel	Intel
Chip set	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440LX	Intel 440BX	Intel 440GX
BIOS	Compaq 68612	Award 4.51PG	Award 4.51PG	Phoenix 4.0	Phoenix 4.0	Phoenix 4.0	Phoenix 4.0	Phoenix 4.0
Hard disk	13.8GB IBM DTTA-371440	6.4GB Fujitsu MPB3064AT	9.8GB Fujitsu MPC3102	6.1GB Maxtor 9064D4	9.6GB IBM DTTA-371010	9.6GB IBM DTTA-371010	13.8GB IBM DTTA-371440	13.8GB IBM DTTA-371440
UDMA/SMART	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Extra mass-storage device	Imega Zip 100	None	Imega Zip 100	None	Imega Zip 100	None	None	Philips CD-RW CDD3610
Expansion-bus slots	2 ISA, 2 PCI, 1 AGP	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 4 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 2 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	5 PCI, 1 PCI/ISA, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	3 / 1	2 / 3	2 / 3	2 / 3	2 / 2	2 / 1	3 / 2	4 / 1
Internal drive bays (5.25" / 3.5")	0 / 0	0 / 2	0 / 1	0 / 2	0 / 2	0 / 1	0 / 3	0 / 5
Power-supply wattage	185	235	235	200	200	70	200	235
Parallel/serial/USB ports	1 / 1 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 1 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2
Tool-free chassis	■	■	■	■	■	■	■	■
Multimedia and Communications								
Graphics adapter (RAM)	ATI Xpert@Play 98 AGP (8MB SGRAM)	Real3D Starfighter AGP (8MB SGRAM)	STB Velocity 4400 AGP (16MB SDRAM)	Integrated AGP (8MB SGRAM)	STB Velocity 4400 AGP (16MB SDRAM)	Integrated AGP (4MB SGRAM)	STB Velocity 4400 AGP (16MB SDRAM)	STB Velocity 4400 AGP (16MB SDRAM)
Graphics chip set	ATI 3D Rage LT Pro	Intel i740	nVidia RIVA TNT	ATI 3D Rage Pro	nVidia RIVA TNT	ATI 3D Rage Pro Turbo 2X AGP	nVidia RIVA TNT	nVidia RIVA TNT
MPEG-2 support in hardware or software	Software	None	Software	Software	Hardware	Software	Software	Hardware
MPEG-2 support device	Quadrant International	N/A	Zoran Soft DVD	Quadrant International	C-Cube ZIVA DS-C	Quadrant International	Quadrant International	Chromatics Mpxect
Monitor	Compaq MV700	Pixie 770	CompUSA CPC 9881	Dell 1000LS	Dell 1200HS	Gateway EV700	Gateway VX700	Gateway VX900
Claimed/measured diagonal size, in inches	17 / 16.8	17 / 16.0	19 / 18.0	17 / 16.5	19 / 18.0	17 / 15.9	17 / 16.1	19 / 18.0
CD-ROM or DVD-ROM drive	2X Hitachi GD-2000 DVD	40X AOpen C40E	2X Hitachi GD-2000 DVD	4.8X Toshiba SD-M1202 DVD	4.8X Toshiba SD-M1202 DVD	2X Matsushita SR-8582 DVD	4.8X Toshiba SD-M1202 DVD	2X Matsushita SR-8582B DVD
PCI sound device	Integrated ESS Maestro 2m	Aureal Vortex	Aureal Vortex	3Com US Robotics 637	Turtle Beach Montego	Integrated Ensoniq ES1371	Integrated Ensoniq ES1371	Creative Labs Sound Blaster AudioPCI
Audio synthesis type	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable
Speakers	JBL Pro CPO46	Altec Lansing ACS43	Altec Lansing ACS45	Harman Kardon HK195	Altec Lansing ACS295	Boston Acoustics BA835	Boston Acoustics BA835	Boston Acoustics Digital Media Theater
Subwoofer	■	■	■	■	■	■	■	■
Microphone/Headphones/Joystick	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Network adapter	Integrated Intel Ether Express Pro 10/100 Mbps (PCI)	None	None	None	None	None	None	None
56K modem standard	K56flex	K56flex	x2	x2	x2	x2	x2	x2
Integrated Software								
Suite or word processor	MS Works 4.5	MS Word 97, MS Works 4.5	MS Word 97	MS Word 97, MS Works 4.5	MS Word 97, MS Works 4.5	MS Word 97, MS Works 4.5	MS Word 97, MS Works 4.5	MS Word 97, MS Works 4.5
Finance	MS Money 98, Quicken Basic 98	MS Money 98	MS Money 98	MS Money 98	MS Money 98	MS Money 98	MS Money 98, Quicken Basic 98	MS Money 98, Quicken Basic 98
Reference	MS Bookshelf 98, MS Encarta 98	MS Encarta 98	MS Encarta 98	MS Encarta 98	MS Encarta 98	MS Encarta 98	MS Bookshelf 98, MS Encarta 98	MS Bookshelf 98, MS Encarta 98
Setup, Service, and Support								
Setup poster/Getting-started video	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Labeled ports/Color-coded cables	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
System CD	■	■	■	■	■	■	■	■
24-hour, 7-day technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	3 years/1 year	3 years/1 year	3 years/1 year	3 years/1 year	3 years/3 years	3 years/3 years	3 years/3 years
On-site service charge for 1 year	Included (90 days)	Included	Included	Included	Included	Included	Included	Included
24-hour turnaround for parts	■	■	■	■	■	■	■	■

N/A—Not applicable. The product does not have this feature.



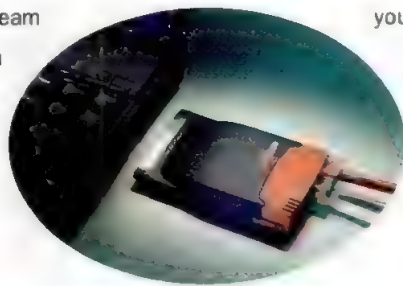
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Continues

Home PCs

	HP Pavilion 6350	HP Pavilion 6390	IBM Aptiva E4N	IBM Aptiva SE7	Micron Millennia 350	Micron Millennia 450 MAX	MidWest Micro Multimedia Pro PRH 400	MidWest Micro Multimedia Pro PRH 450
■ YES □ NO								
Products listed in review order.								
Price of tested configuration	\$1,300 street	\$2,800 street	\$1,550 street	\$3,050 street	\$1,899 direct	\$2,533 direct	\$1,499 direct	\$2,399 direct
Category	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end
Processor	AMD K6-2/333	Pentium II/450	AMD K6-2/350	Pentium II/450	Pentium II/350	Pentium II/450	Pentium II/400	Pentium II/450
Installed/maximum SDRAM (MB)	64 / 256	128 / 384	64 / 256	128 / 384	64 / 256	128 / 384	64 / 1,024	128 / 1,024
Installed L2 pipelined-burst cache	512K	512K	512K	512K	512K	512K	512K	512K
Motherboard manufacturer	Asus	Asus	IBM	IBM	BCM	Intel	Giga-Byte	Giga-Byte
Chip set	SiS 5597	Intel 440BX	ALi M1542	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
BIOS	Phoenix 4.0	Phoenix 4.0	IBM 3.2	IBM 3.2	Award 4.51PG	Phoenix 4.0	Award 4.51PG	Award 4.51PG
Hard disk	7.7GB Quantum Bigfoot TX	9.8GB Quantum Fireball EL	7.7GB Quantum Bigfoot TX	16.1GB IBM DTTA-351680	9.6GB IBM DTTA-371010	13.8GB IBM DTTA-371440	6.1GB Quantum Fireball EX	12.2GB Quantum Fireball EX
UDMA/SMART	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Extra mass-storage device	None	None	None	None	None	Imega Zip 100	None	Imega Zip 100
Expansion-bus slots	2 ISA, 2 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 1 PCI/ISA, 1 AGP	1 ISA, 2 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 2 PCI	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	1 / 1	2 / 1	2 / 2	3 / 1	2 / 1	2 / 3	3 / 2	3 / 2
Internal drive bays (5.25" / 3.5")	0 / 0	1 / 1	1 / 2	0 / 1	0 / 1	0 / 2	0 / 2	0 / 2
Power-supply wattage	110	235	95	100	145	300	200	200
Parallel/serial/USB ports	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 1 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2
Tool-free chassis	■	■	■	■	■	■	■	■
Multimedia and Communications								
Graphics adapter (RAM)	Integrated PCI (4MB SGRAM)	Integrated AGP (8MB SGRAM)	Integrated AGP (4MB SGRAM)	Integrated AGP (4MB SGRAM)	Integrated PCI (8MB SGRAM)	Diamond Viper V550 AGP (16MB SGRAM)	STB Velocity 128 AGP (8MB SGRAM)	ATI Xpert@Play 98 AGP (8MB SGRAM)
Graphics chip set	SiS 5598	ATI 3D Rage Pro Turbo 2X AGP	ATI 3D Rage Pro Turbo 2X AGP	ATI 3D Rage Pro Turbo 2X AGP	nVidia RIVA 128ZX	nVidia RIVA TNT	nVidia RIVA 128	ATI 3D Rage Pro Turbo 2X AGP
MPEG-2 support in hardware or software	None	Software	None	Software	Software	Hardware	None	Software
MPEG-2 support device	N/A	Quadrant International	N/A	Mediamatics DVD Express	Zoran SoftDVD	Diamond Viper 550	N/A	Quadrant International
Monitor	HP M50	HP M70	IBM C50	IBM G94	Micron 700VX	Micron 900LX	Clearmax CM-1726	Clearmax CM-1926
Claimed/measured diagonal size, in inches	15 / 13.8	17 / 16.0	15 / 13.8	19 / 17.8	17 / 15.9	19 / 17.8	17 / 15.5	19 / 18.5
CD-ROM or DVD-ROM drive	24X Goldstar 8240B	2X Hitachi GD-2000 DVD	24X AOpen CD-924E	2X Hitachi GD-2000 DVD	2X Toshiba SD-M1102 DVD	2X Hitachi GD-2000 DVD	32X Pioneer DR-A14S	4.8X Toshiba SD-M1202 DVD
PCI sound device	Integrated Crystal CS4237	Integrated Ensoniq ES1371	Integrated Crystal CS 4235-KQ	Integrated Crystal CS4235-KQ	Integrated Ensoniq Maestro 2m	Integrated Yamaha XG	Creative Labs Sound Blaster PCI64	Creative Labs Sound Blaster PCI64
Audio synthesis type	FM	FM, wavetable	Wavetable	Wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable
Speakers	Polk Audio N27	Polk Audio N27	IBM Infinity	IBM Infinity	Advent 009	Monsoon MM1000	Labtech LCS 2632	Altec Lansing ACS90
Subwoofer	■	■	■	■	■	■	■	■
Microphone/Headphones/Joystick	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Network adapter	None	None	None	None	None	None	None	None
56K modem standard	K56flex	K56flex	K56flex	K56flex	x2	x2	K56flex	K56flex
Integrated Software								
Suite or word processor	MS Works 4.5	MS Works 4.5	Lotus Smart Suite 97	Lotus Smart Suite 97	MS Office 97 SBE	MS Office 97 SBE	MS Works 4.5, MS Word 97	MS Works 4.5, MS Word 97
Finance	MS Money 98, Quicken Basic 98	MS Money 98, Quicken Basic 98	None	None	None	None	MS Money 99	MS Money 99
Reference	MS Encarta 98	MS Encarta 98	None	World Book Encyclopedia	None	None	MS Encarta 98	MS Encarta 98
Setup, Service, and Support								
Setup poster/Getting-started video	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Labeled ports/Color-coded cables	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
System CD	■	■	■	■	■	■	■	■
24-hour, 7-day technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3-5 years/1 year	3-5 years/1 year	3-5 years/1 year	3-5 years/1 year
On-site service charge for 1 year	Included (90 days)	Included (90 days)	N/A	N/A	Included	Included	Included	Included
24-hour turnaround for parts	■	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.



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SUMMARY OF FEATURES

Home PCs

Ends

■ YES ■ NO

Products listed in review order.

	NEC Ready 9910	Packard Bell Platinum 7800	Pionex 6350-X	Pionex 6450-X	Quantex QP6/350 M-2x	Quantex QP6/450 M-4x SE	Sony VAIO PCV-E204	Sony VAIO PCV-E308DS
Price of tested configuration	\$2,380 street	\$1,300 street	\$1,500 street	\$2,200 street	\$1,599 direct	\$2,699 direct	\$1,750 street	\$2,800 street
Category	High-end	Mainstream	Mainstream	High-end	Mainstream	High-end	Mainstream	High-end
Processor	Pentium II/450	Pentium II/350	Pentium II/350	Pentium II/450	Pentium II/350	Pentium II/450	Pentium II/333	Pentium II/450
Installed/maximum SDRAM (MB)	128 / 384	64 / 384	64 / 384	128 / 768	64 / 384	128 / 384	64 / 256	128 / 256
Installed L2 pipelined-burst cache	512K	512K	512K	512K	512K	512K	512K	512K
Motherboard manufacturer	Packard Bell	Packard Bell	Micro-Star	Micro-Star	Micro-Star	Micro-Star	GVC	GVC
Chip set	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440EX	Intel 440BX
BIOS	Phoenix 4.0	Phoenix 4.0	AMI 1.283	AMI 1.2	AMI 1.2	AMI 1.2	Phoenix 4.0	Phoenix 4.0
Hard disk	13GB Maxtor 91360D8	6.1GB Maxtor 9064D4	8.2GB Seagate ST38641A	11.5GB Quantum Bigfoot TX	8.2GB Seagate Medalist 8641	13.8GB IBM DTTA-371440	6.2GB Maxtor 90648D5	9.7GB Maxtor 91020D6
UDMA/SMART	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Extra mass-storage device	None	None	None	None	None	Iomega Zip 100	None	None
Expansion-bus slots	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	2 ISA, 3 PCI, 1 PCI/ISA, 1 AGP	1 ISA, 2 PCI, 1 AGP	4 PCI, 1 AGP
Front-accessible drive bays (5.25" / 3.5")	3 / 2	3 / 2	4 / 1	4 / 1	4 / 1	4 / 1	1 / 1	1 / 1
Internal drive bays (5.25" / 3.5")	0 / 1	0 / 0	0 / 4	0 / 4	0 / 4	0 / 4	0 / 2	0 / 2
Power-supply wattage	200	200	230	230	235	235	90	90
Parallel/serial/USB ports	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2	1 / 2 / 2
Tool-free chassis	■	■	■	■	■	■	■	■

Multimedia and Communications

Graphics adapter (RAM)	ATI Xpert@Play 98 AGP (8MB SGRAM)	ATI 3D Charger AGP (4MB SGRAM)	Cirrus Logic Apollo AGP (4MB SDRAM)	STB Velocity 4400 AGP (16MB SDRAM)	Joytech Apollo Media2 AGP (4MB SGRAM)	STB Velocity 4400 AGP (16MB SDRAM)	Integrated AGP (4MB SGRAM)	Integrated AGP (8MB SGRAM)
Graphics chip set	ATI 3D Rage Pro Turbo 2X AGP	ATI 3D Rage IIC	Cirrus Logic 3DA-5465	nVidia RIVA TNT	Chromatics Mipact	nVidia RIVA TNT	ATI 3D Rage Pro Turbo AGP	Matrox G200
MPEG-2 support in hardware or software	Software	None	None	Software	Hardware	Software	Software	Software
MPEG-2 support device	Zoran Soft DVD	N/A	N/A	Quadrant International	Chromatics Mipact	Quadrant International	Quadrant International	Quadrant International
Monitor	NEC C700	Packard Bell 7480	Nanao FX12	CTX V1700	Amtran AT897D	Amtran AT1097F	Sony Trinitron CPD-201VS	Sony Trinitron CPD-201VS
Claimed/measured diagonal size, in inches	17 / 15.9	17 / 15.9	15 / 13.8	17 / 16.0	17 / 16.0	19 / 17.8	17 / 16.0	17 / 16.0
CD-ROM or DVD-ROM drive	2X Hitachi GD-2000 DVD	32X NEC 28C	32X Lite-On LTN-301	2X Toshiba SD-M1102 DVD	4.8X Toshiba SD-M1202 DVD	4.8X Toshiba SD-M1202 DVD	4X Hitachi GD-2500BUSV	5X Sony DDV-220E DVD
PCI sound device	Integrated Crystal CS4611	Integrated Crystal PnP	Creative Labs Sound Blaster AudioPCI 64V	Aztec PCI 338-A3D	Creative Labs Sound Blaster AudioPCI 64V	Creative Labs Sound Blaster AudioPCI 64V	Integrated ESS ES1938	Aureal 8820
Audio synthesis type	Wavetable	FM	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable	FM, wavetable
Speakers	NEC	Integrated in monitor	Mli 69L	Altec Lansing ACS45	Altec Lansing ACS45.1	Altec Lansing ADA305	Integrated in monitor	Integrated in monitor
Subwoofer	■	■	■	■	■	■	■	■
Microphone/Headphones/Joystick	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Network adapter	None	None	None	None	None	None	None	None
56K modem standard	K56flex	K56flex	K56flex	K56flex	K56flex	K56flex	K56flex	K56flex

Integrated Software

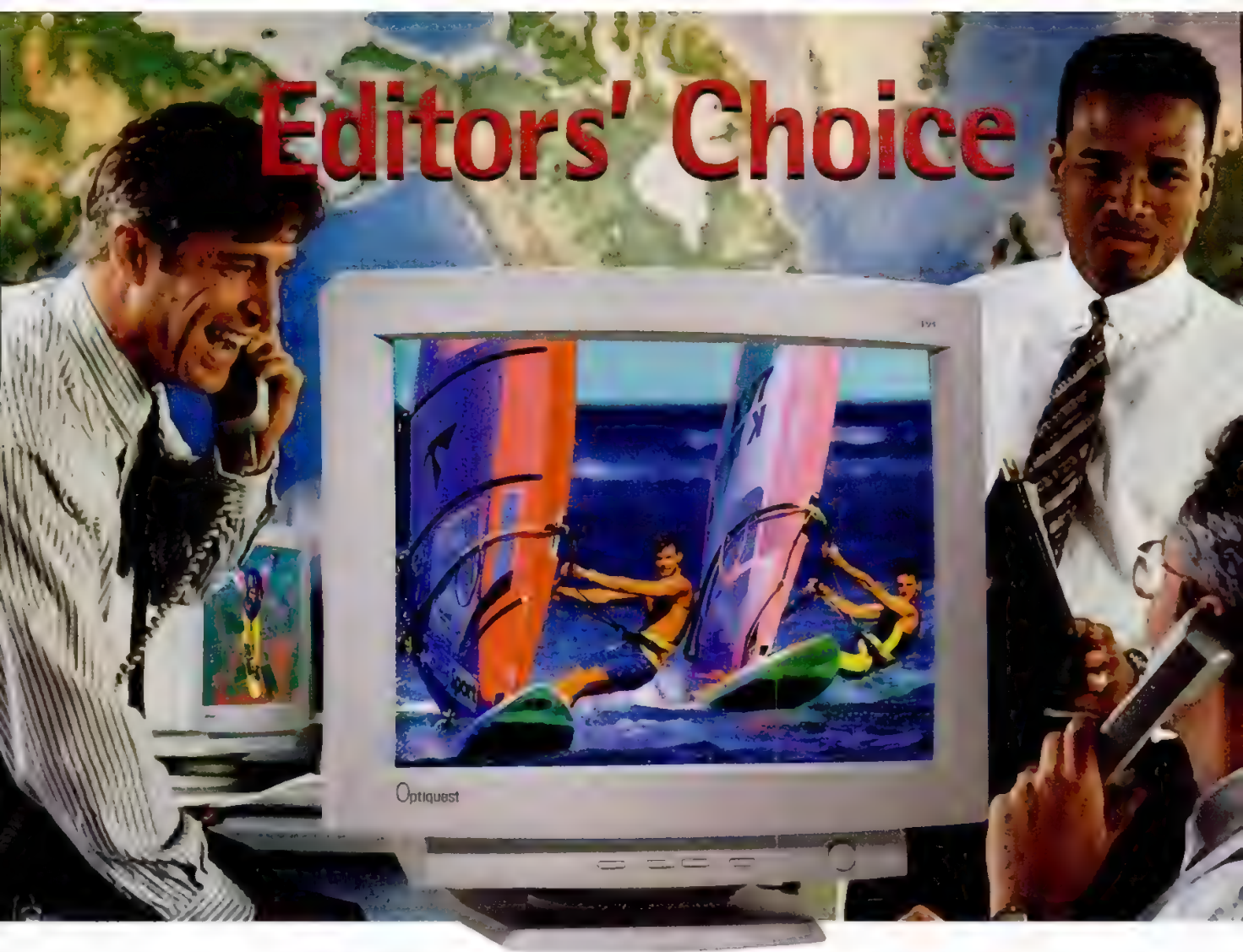
Suite or word processor	MS Word 97, MS Works 4.5	MS Word 97, MS Works 4.5	Corel Word- Perfect Suite 8	Corel Word- Perfect Suite 8	Corel Word- Perfect Suite 8	Corel Word- Perfect Suite 8	MS Works 4.5	MS Works 4.5
Finance	Quicken Basic 98	Quicken Basic 98	MS Money 98	MS Money 98	MS Money 98	MS Money 98	MS Money 98, Quicken Basic 98	MS Money 98, Quicken Basic 98
Reference	MS Encarta 98	MS Encarta 98	Compton's Encyclopedia, Compton's Reference Collection	Compton's Encyclopedia, Compton's Reference Collection	Compton's Encyclopedia, Compton's Reference Collection	Compton's Encyclopedia, Compton's Reference Collection	MS Encarta 98	MS Encarta 98

Setup, Service, and Support

Setup poster/Getting-started video	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Labeled ports/Color-coded cables	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
System CD	■	■	■	■	■	■	■	■
24-hour, 7-day technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/1 year	3 years/1 year	1 year/1 year	1 year/1 year
On-site service charge for 1 year	\$70	\$70	Included	Included	Included	Included	Included	Included
24-hour turnaround for parts	■	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature

Editors' Choice



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"Optquest" bills its monitors as consistent performers for reasonable prices, and the excellent Optquest V75 and V95 bear this out. Both are among the best in their respective size classes and perform handily in a wide variety of applications."

PC Magazine, October 6, 1998 - page 202

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Optquest V95
October 1998

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Optimal Resolution	1280 x 1024 @ 89Hz	1280 x 1024 @ 88Hz	1280 x 1024 @ 88Hz



Optquest V95
September 1998



Optquest V95
July 1998



Optquest V95
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IBM Aptiva SE7

X 6.0 driver problems and could not run our 3D WinMark test.

The off-white E4N lacks a DVD drive and uses a standard keyboard. It was shipped to us with a malfunctioning second speaker; not unexpectedly, given its AMD processor, it is a poor performer. The E4N is a serviceable system capable of pleasing first-time users, however. As with the SE7, IBM provides a setup poster, color-coded cables, an ample troubleshooting guide in booklet form, and much easily accessible documentation on hard disk—not to mention a copy of Lotus SmartSuite.

IBM's one-year warranty lacks on-site service, but the company is on hand around the clock, all year should you need to call for technical support. Both units offer easy access to the Internet (including 100 hours free on AOL) and free connections to IBM's Web site, where you can gather support information and automatically install software updates. But in addition to having speaker problems with the E4N, we were unable to install a device adequately via its USB port, and neither machine has an AGP slot.—CM

Micron Millennia 350, 450 MAX

350: Pentium II/350, 64MB SDRAM, 9.6GB disk, 17" monitor. Business Winstone 99: 18.4. \$1,627. **450 MAX:** Pentium II/450, 128MB SDRAM, 13.8GB disk, 19" monitor. Business Winstone 99: 23.9. \$2,533 direct. Nampa, ID; 888-634-8799, 208-893-3343; www.micronpc.com; 507 at www.pcmag.com/infolink.

● The two Micron Millennia PCs offer the superb performance and solid hardware that power users love; the high-end unit, especially, is a great gaming and multimedia PC. Entry-level users, however, won't find the assistance they need.

The 450 MAX midtower is a power-

user's delight. Its downright stunning sound system—ideal for a single user—includes thin Sonigistix Monsoon MM-1000 electrostatic speakers and a large subwoofer. Its graphics system includes a Diamond DTV 2000 TV tuner upgrade for its Viper 550 AGP graphics card. A removable 100MB Iomega Zip Drive also comes standard.

The 350 comes in Micron's new micro-tower case, which keeps its price down but has just one free bay. Its microATX motherboard has integrated graphics circuitry, so two PCI slots are free.

While Micron's documentation is fairly complete, new users will find themselves mired in computer jargon. The 450 MAX comes with Micron's Customer Resource CD, which includes drivers, system documentation, and videos on how to open and upgrade the Millennias, but elementary help, such as how to surf the World Wide Web, is not included.

Both PCs posted top Winstone 99 scores for their class; only the Xeon-based Gateway GX450-XL outperformed the 450 MAX. The high-end 450 MAX also tied with the high-end Dell PC for first place on our 3-D tests. While both came with DVD drives, the 450 MAX lacked DVD player software (Micron claims this will be included standard). The mainstream unit's DVD playback was fair, with some disruption of the image, although the audio quality was good. Bundled software was good.

By the time you read this, Micron will offer keyboards with one-touch application and Internet-access launch standard with the units. Thirty-day free Internet

access is available through AT&T or EarthLink; AT&T does not require a credit card during the trial period.—RSA

MidWest Micro Multimedia Pro PRH 400, PRH 450

PRH 400: Pentium II/400, 64MB SDRAM, 6.1GB disk, 17" monitor. Business Winstone 99: 19. \$1,499. **PRH 450:** Pentium II/450, 128MB SDRAM, 12.2GB disk, 19" monitor. Business Winstone 99: 21.8. \$2,399 direct. Fletcher, OH; 800-626-0544, 937-368-2309; www.mwmicro.com; 508 at www.pcmag.com/infolink.

● For experienced users, the mainstream PRH 400 is a fair value with few frills, while the high-end PRH 450 sweetens the pot with better performance, greater storage, and more entertainment features. MidWest Micro doesn't break new ground with ease of use, access, documentation, or customer support, but it has a good warranty that bears some attention.

The PRH 400's medium-size tower case has ample expansion room for drives and adapter cards, but there is only one free IRQ. Setup is straightforward, aided by a single-fold chart. The user guide provides only minimal system and component information; worse, it covers three case designs, an approach that detracts from its specificity. There is no troubleshooting guide; only Microsoft Internet Explorer's Internet sign-up wizard is included.

Stepping up to the PRH 450, MidWest Micro adds better core components; an internal Zip Drive; upgraded, party-level LabTech speakers with a huge subwoofer; and a DVD-2 drive. The PRH 450's setup chart is different from the PRH 400's, but the system has the same user guide.

Both PCs performed well on our Winstone test, but the PRH 450 did poorly on our 2-D and 3-D graphics tests. DVD playback on the high-end system was good.

Software includes Microsoft Home Essentials and MidWest Micro's Life-styles Series entertainment pack. Other software packs are available for \$20 each.

MidWest Micro users can call toll-free for technical support for hardware and software problems, but there's a \$24.95-per-call charge for help in learning how to



Micron Millennia 450 MAX



Midwest Micro Multimedia Pro PRH450

use the software. Midwest's Web site has a fair amount of support information, including a searchable knowledge base and a Technician's Almanac, as well as online manuals and driver updates.—BB

NEC Ready 9910

Pentium II/450, 128MB SDRAM, 13GB disk, 17" monitor. Business Winstone 99: 21.4. \$2,380 street. Sacramento, CA; 800-733-5858, 916-388-0101; www.nec-computers.com; 509 at www.pcmag.com/infolink.

● This NEC Ready PC isn't among the market's leading home systems, but it benefits from satisfactory help software and

multimedia. NEC Ready PCs, built for the home and sold retail, are manufactured by the Consumer Products Division of Packard Bell NEC. Unsurprisingly, there are similarities between the Ready 9910, meant for small-office and home-office users, and the Packard Bell Platinum 7800 (also reviewed). Using similar documentation and software-based help tools, both PCs are fairly easy to use. Unlike the Platinum, however, the Ready offers reasonable audio as well as respectable performance.

The mini-tower has a relatively helpful user guide, a software-based tutorial, and a great deal of online documentation. This documentation does not provide help on the keyboard's DVD controls and application buttons, which were not operational on our test unit, but it does provide informa-

tion on most other important subjects. An NEC Assistant, like Packard Bell's Navigator Assistant, sits in the corner of your Windows desktop and links you to important applications and tools.

The system did not perform well on our 2-D and 3-D graphics tests, but it was otherwise adept. DVD playback was good unless other applications were also running. NEC provides technical support from 7:00 A.M. to 3:00 A.M. eastern time, 7 days. The unit comes with Microsoft Word 97 and other software.—CM



NEC Ready 9910/Packard Bell Platinum 7800

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Packard Bell Platinum 7800

Pentium II/350, 64MB SDRAM, 6.1GB disk, 17" monitor. Business Winstone 99: 7.1. \$1,300 street. Sacramento, CA; 800-733-5858, 916-388-0101; www.packardbell.com; 510 at www.pcmag.com/infolink.

● The mainstream Packard Bell Platinum 7800 offers some good help tools, online documentation, and Windows enhancements, but it has inadequate print documentations and its hardware performed well below average on most tests. We suspect that the unit's graphics driver caused problems at XGA resolution and led to the unit's poor showing on our graphics and Winstone tests. Packard Bell NEC sells the unit retail to home users desiring high-end hardware and performance.

Color-coded cables, a detailed setup poster, and a short tutorial let you set up the system quickly, connect to the Internet, and familiarize yourself with various software applications. Once the system is up and running, Packard Bell's Navigator Assistant—which can be removed easily—gives you quick access to important applications and help tools. The latter, collected in the Support Center, provides hardware and software documentation as

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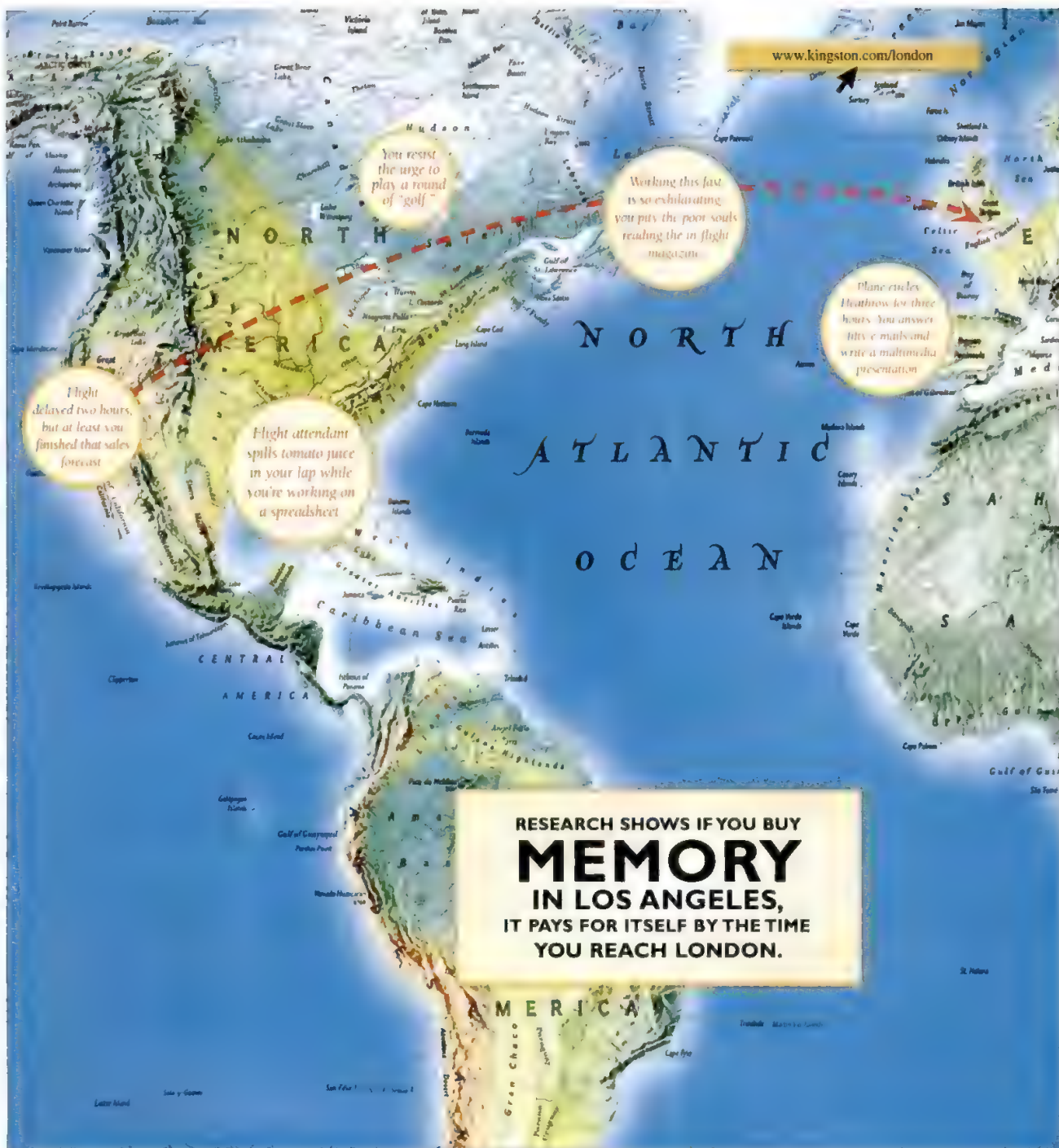
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well as tutorials on how to use the PC and solve problems. Thorough paper documentation, however, was lacking, as was initial setup troubleshooting help.

The keyboard has CD-ROM controls and other application buttons, but the special buttons weren't working on our test system. The unit has monitor-integrated stereo speakers and some good software, such as Microsoft Word 97 and Quicken Online Financial Center.

Packard Bell's one-year warranty does not include on-site service, but daily technical support hours extend from 7:00 A.M. to 3:00 A.M. eastern time. Buyers can collect \$200 in rebates; \$100 simply for using the system and \$100 for using the bundled EarthLink Internet service.—CM

Pionex 6350-X, 6450-X

6350-X: Pentium II/350, 64MB SDRAM, 8.2GB disk, 15" monitor. Business Winstone 99: 15.5. \$1,500. **6450-X:** Pentium II/450, 128MB SDRAM, 11.5GB disk, 17" monitor. Business Winstone 99: 21.4. \$2,200 street. Somerset, NJ; 800-313-1995, 732-356-9299; www.pionex.com; 511 at www.pcmag.com/infolink.

● Pionex consumer PCs, sold exclusively through retail outlets, are inexpensive, but neither is well documented or particularly easy to use. The \$1,500 mainstream model came to us with a fairly helpful setup poster but lacked color-coded cables and comprehensive documentation. Its \$2,200 high-end sibling, boasting a DVD drive, lacked even the setup poster.

Both midtowers have familiar screw-fastened chassis. The 6450-X is equipped with a DVD drive that provides serviceable video (unless you run other applications simultaneously, which makes the video play choppy), and an admirable sound system complete with a subwoofer. The 350-MHz machine is limited to a pair of MLI speakers and a 32X CD-ROM drive. The 6450-X's graphics subsystem performed very well during testing, but the 6350-X could not run our 3-D tests, possibly because of problematic DirectX 6.0 drivers. Its other scores ranged from average to below average for its class.

As said, Pionex provides little help for users aside from tossing in documentation for third-party hardware devices and software packages. But the company offers one year of on-site service and 24-hour, 7-day



phone support for the life of the PC. The Pionex Web site has driver and BIOS updates, and bug fixes.

The Pionex PCs do well in the area of bundled software, which includes Corel WordPerfect Suite 8, Microsoft Money 98, and Compton's Encyclopedia.—CM

Quantex QP6/350 M-2x, QP6/450 M-4x SE

QP6/350 M-2x: Pentium II/350, 64MB SDRAM, 8.2GB disk, 17" monitor. Business Winstone 99: 14.2. \$1,599. **QP6/450 M-4x SE:** Pentium II/450, 128MB SDRAM, 13.8GB disk, 19" monitor. Business Winstone 99: 23.4. \$2,699 direct. Somerset, NJ; 800-346-6572, 732-563-4166; www.quantex.com; 512 at www.pcmag.com/infolink

● With good software bundles, some documentation, and solidly average performance, the high-end QP6/450 M-4x SE and mainstream QP6/350 M-2x are useful and somewhat friendly home PCs. They don't have amenities such as programmable keyboards or video tutorials, but beginners will find some of the help they need.

Quantex does a fairly good job of taking generic PCs and packaging them with enough documentation to provide help basics. In addition to foldout quick-setup guides, the units come with illustrated user



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manuals and a guide to using the Internet. All rear ports were labeled with icons. However, know that if you run into problems there is no troubleshooting guide either for setup or later problems. Quantex also lacks on-disk documentation.

Both units use the same spacious case and have good audio, courtesy of Creative Labs AudioPCI cards and Altec Lansing speakers with subwoofers. The high-end PC also has a 100MB Iomega Zip Drive.

Each unit was an average performer in its class on our Winstone 99 tests. When tested with a music video DVD, both units yielded reasonable audio, but their video images revealed some fuzziness, especially when viewed in full-screen mode. Thanks to its STB Velocity 4400 AGP graphics card, the high-end unit did well on our 3-D tests, but because of driver problems, the mainstream unit, which uses a Joytech Apollo Media2 AGP graphics card, could not run 3D WinMark 99.

Quantex enhances both units with a large bundle of business and entertainment software, including Corel WordPerfect Suite 8 and a number of Compton's educational titles. Quantex gives you a three-year-parts, one-year-labor warranty with one year of on-site service. Technical support is available round the clock.—*RSA*

Sony VAIO PCV-E204, PCV-E308DS

PCV-E204: Pentium II/350, 64MB SDRAM, 6.2GB disk, 17" monitor. Business Winstone 99: 15.6. \$1,750. **PCV-E308DS:** Pentium II/450, 128MB SDRAM, 9.7GB disk, 17" monitor. Business Winstone 99: 21.9. \$2,800 street. San Jose, CA; 800-236-1877, 408-432-1600; www.sel.sony.com; 513 at www.pcmag.com/infolink

● Not intended for entry-level users, the new Sony VAIO Digital Studio (DS) line is bound to be a hit with its target market: A/V enthusiasts, for whom it is specifically configured. The PCV-204 is not as A/V heavy and is intended more as an entry-level multimedia system. Both benefit from extensive resources on Sony's Web site.

The high-end PCV-E308DS has three key A/V interfaces: SPDIF (optical digital audio out, for such tasks as MiniDisc editing), S-Link (Sony's Hi-Fi product control interface), and i.Link, Sony's name for the IEEE 1394 (FireWire) digital video and peripheral interface. Other than the interfaces, no A/V hardware is included, but the software includes titles for editing and managing still images, digital video, and digital

audio. If you're heavily invested in A/V equipment (especially from Sony), the E308DS gives you the interfaces and software tools to make them work together.

The PCV-E204 is more modest but shares some of the A/V features of the high-end unit, such as S-Video and RCA video out. The unit's disk is slightly larger than standard configurations, but adds just \$50 to its price. Both units are housed in similar mini-towers, which are cramped and have limited expandability. The two also come with some productivity titles.

Documentation, including a setup chart plus getting-started and reference manuals, was good, though we saw only representative samples from earlier models and not the final versions for the high-end unit. An optional alternate interface, VAIO II, also comes with the units. It uses a frame-like method of organizing system applications and information but is only a minor improvement over Windows 98. Both PCs come with programmable keyboards for one-touch launch of popular applications.

The units performed well on most of our tests. The PCV-204's 3-D graphics score was weak, but the high-end unit had a fair 3-D score, though it was not as high as true gamers would want. Both PCs came with DVD drives and had acceptable playback as long as the resolution was set to 800-by-600 with 16-bit color. Otherwise there were pauses in play.

Sony's Internet resources are extensive and include a new portal developed with CNET and MSNBC called ClubVaio (<http://clubvaio.snap.com>). This portal is a search engine with daily news and weather updates and can be customized. You can also order VAIO products and access technical support from this site.—*BB PC*



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As in past years, our editors, senior contributors, and PC Magazine Labs project leaders and technical directors got the ball rolling in late August, as we began posting nominations and discussing them in a dedicated database.

We saw a significant advance in standards this year, as XML broke out of the lab. And we saw huge strides forward in digital imaging, with lots of digital cameras and other peripherals and software.

We're pleased to present our 1998 winners and finalists in nine product categories, along with our awards for the people who have had the most impact on our industry over the past year, and our annual award for lifetime achievement.—*Michael J. Miller*

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WINNER

Toshiba Tecra 8000

If ever a system truly defined technical excellence—not only advancing the state of the computing platform, but also doing so to the direct benefit of the user—it's the Toshiba Tecra 8000. This machine, introduced in August, has effectively redefined high-end notebook computing.

To understand the Tecra 8000 best, you must compare the unit with its predecessor, the Toshiba Tecra 780 DVD—*itself a state-of-the-art desktop replacement machine.* At introduction, the Tecra 8000 incorporated much of the same cutting-edge hardware as the Tecra 780 but was a half-inch thinner, 2 pounds lighter, and more than \$2,000 cheaper. The new system was barely 1.7 inches thick and weighed just over 6 pounds, despite including a 266-MHz Pentium II, a 13.3-inch TFT display, a 6.3GB hard disk, and an additional drive bay. Even when accompanied by its CD-ROM (which slides into the drive bay) and AC adapter, it weighed only 7 pounds.

Since its debut, the Tecra 8000 has only gotten better. Now, you can get this portable with a 14.1-inch display, a second-generation DVD drive, and a 300-MHz Pentium II processor—and the travel weight is still just over 7 pounds, which is virtually unheard of for this class of notebook. Toshiba was the first vendor to bring the new low-profile DVD device to market in a portable. The drive is just 12.7 mm thick, fitting neatly into the Tecra 8000's existing bay. And best of all? With its biggest display, fastest processor, DVD, and 64MB of RAM, it costs around \$4,400.

The Tecra 8000 outperformed almost every Pentium II notebook we had ever reviewed and, with a 3,750-mAh lithium ion pack, offered more than 3 hours of battery life.



Amazingly, Toshiba builds the Tecra 8000 according to customer specs from 5,832 possible configurations. You choose among multiple processors, memory sizes, screen sizes, hard disks, OSs, and accessories. This does not mean, however, that corporate customers must juggle multiple software builds when they purchase varying configurations. Always equipped with the same motherboard, BIOS, and graphics subsystem, the Tecra 8000 lets you standardize on one software image.

Toshiba Computer Systems Division, Irvine, CA; 888-598-7802, 949-583-3000, www.toshiba.com.

FINALISTS

Sony VAIO 505 Slimline Notebook

Sony put the portable back into portable computing with the VAIO 505 Slimline Notebook line of PCs. A VAIO 505 is a real computer, not a toy, with a system weight a hair under 3 pounds. And you can carry it just about anywhere, thanks to its sleek and rugged magnesium alloy case and diminutive size: 0.9 by 10.2 by 8.2 inches.

The VAIO 505 has enough power to perform most road warrior tasks, with as much as a 266-MHz Pentium MMX processor, a 10.4-inch active-matrix SVGA display, a 2.1GB or 4.3GB hard disk, as well as 64MB of RAM standard (up to 96MB). In addition, road warriors will appreciate that the V.90 modem is built in—no PC Card modem and dongle required.

Two special features set the VAIO 505 apart from most other notebooks big or small: ScribblePad and i.Link. The touch pad works with your finger, of course, as well as with an included stylus and the ScribblePad application, which lets you record your signature, draw a map, or quickly sketch out a concept, then include it in a document. i.Link is an industry term (for which Sony designed a logo) for the IEEE-1394 (FireWire) high-speed connector, which lets you capture images from a digital video camera or camcorder. A host of accessories, including an extended-life battery (highly recommended), clip-on stereo speakers, and an external CD-ROM drive let you carry extra power and capability in manageable chunks.

It all makes for a complete and technically pleasing package.

Sony Electronics Inc., San Jose, CA; 408-432-1600; www.sony.com.

Apple iMac

One thing's for sure: the Apple iMac is rarely met with indifference. Whether you applaud its translucent blue design, marvel at how quickly it can be set up and powered on, or scoff at its lack of a floppy disk drive, you have to admit that the latest successor to the famed and fabled Apple Macintosh elicits strong opinions. It is unlike anything that came before it—and definitely moves things in a new direction.

Priced under \$1,300 at introduction, the iMac is an inexpensive machine that nonetheless redefines traditional concepts of PC aesthetics and ease of use. Housing a CD-ROM drive, Ethernet connection, modem, stereo speakers, and monitor—in addition to its core computing hardware—within its compact and conspicuously attractive chassis, the system can be set up in under 10 minutes. You need merely connect its USB mouse and USB keyboard to the chassis, plug the iMac's power cord into an outlet, plug its Ethernet or modem cable into the wall, and turn it on. And this is what matters most to many users—how easily they can get the machine up and running, and how much they can do on it with the least amount of fuss.

Indeed, many don't like the iMac's lack of a floppy disk drive—or its dependence on USB, which supports few existing Macintosh peripherals. But Apple has taken a stand, proclaiming that the floppy disk drive is nearing obsolescence and promoting USB as an interface of the future.

Nonetheless, users have the option of adding an Imation SuperDisk drive and will soon be able to purchase devices for connecting older peripherals. It's Apple's blend of innovation and concern for the end user that makes the iMac unique.

Apple Computer Inc., Cupertino, CA; 800-767-2775, 408-996-1010; www.apple.com.

WINNER

Macromedia Web Tools

With a stable of products for creating content for CD-ROM, print, videotape, or the Internet, Macromedia is a player in many markets. But the company has seen its future, and it is the Web. With its formidable rosters of tools, from Dreamweaver to Generator to Flash and Fireworks, Macromedia sets the bar high with a complete approach to Web-page authoring and Web graphics and multimedia content.

From its earliest days, Dreamweaver was an obvious leader in the Web authoring market. Even now, Dreamweaver is the only tool that supports true round-trip HTML editing so you can switch between WYSIWYG and source-code editing without a hitch. To build sophisticated Web pages, Dreamweaver relies on a mix of style sheets and Dynamic HTML. By the end of the year, Macromedia plans to release Dreamweaver 2.0, a major upgrade.

In 1998, the Web got its own specialized tools for designing graphics, and Macromedia was one of the first to address this emerging market. In our first comparative review of Web graphics tools (November 3, 1998), we awarded Fireworks an Editors' Choice for its unmatched range of tools for creating and optimizing images for the Web.

More recently, Macromedia unveiled Generator, a solution that automatically generates personalized graphics on the fly, drawing from a database. The Generator line includes the Generator Developer's Studio for authoring graphics templates, as well as the Generator Dynamic Graphics Server. Generator produces graphics in a variety of formats and is useful for any images that draw on dynamic data, such as weather maps and stock tickers.

Generator also supports Flash 3, Macromedia's vector-



based format for graphics and animation that has become a de facto standard on the Web. Although Flash is facing competition from Adobe's Precision Graphics Markup Language, Macromedia has a big head start in the standards race. Flash has already been integrated into America Online 4.0, Netscape Communicator, and Windows 98. Also this year, Macromedia released a major upgrade to its Flash design tool. New features in Flash 3 include support for transparency, sprite animation that makes it easier to create elements such as buttons and check boxes, and shape-morphing for generating animation quickly. The Flash Projector lets designers package Flash files and the player in a single file.

Add up all the pieces and no other software currently matches Macromedia's lineup of Web tools and technologies. **Macromedia Inc.**, San Francisco; 800-457-1774; www.macromedia.com.

FINALISTS

MGI PhotoSuite II

The Web has been the biggest influence on software design since the introduction of the graphical operating system. Nowhere is this impact more evident than in MGI Software's PhotoSuite II, a PC photography editing package that takes Internet integration to a new level.

MGI made its mark with the 1996 release of PhotoSuite, which quickly became one of the top-selling titles for capturing, editing, and sharing photographs using the PC. But it is the second iteration of PhotoSuite that breaks new ground by unveiling an architecture dubbed the Windows Internet Technology (also known as Dynamic Client) and based entirely on an embedded browser (Microsoft Internet Explorer 4.0).

All of PhotoSuite II's features and tools are grouped into ActiveX controls that are seamlessly incorporated in the program's DHTML interface. This approach offers several advantages. First, the program looks and acts like a Web site, which makes it easier to use. Second, users can scour the Web for new content from within PhotoSuite II. Third, because every aspect of the program is parsed into components, users can download not only updates but also new features, project templates, and content on the fly. The dynamic Client approach can also be a boon to the makers of software, freeing them from major upgrade cycles, establishing a better channel for obtaining feedback during beta tests, and making it vastly easier to tailor applications to niche markets.

By forging the framework for more dynamic applications, PhotoSuite II points the way toward the end of the era of one-size-fits-all software.

MGI Software Corp., Ontario; 888-644-7638, 905-764-7000; www.mgisoft.com.

Trellix 2.0

The brainchild of Dan Bricklin, who is best known for codeveloping the first electronic spreadsheet, Trellix is nearly as ambitious a product. Equal parts word processor, presentation graphics program, and Web authoring tool, Trellix aims to unlock the potential of corporate intranets by letting anyone create and maintain documents with the sophistication of professional Web sites. To create a Trellix document, you can enter data into one of 27 design templates or import existing documents or Web pages. A unique Content Map—similar to a Web site map—lets you easily organize information in large documents and navigate within them. You can share Trellix documents by publishing them on an intranet where they can be viewed in a standard browser or via e-mail using the innovative Trelligram utility.

If the first version of Trellix was more of a proof-of-concept, the second iteration, Trellix 2.0, truly delivers on the promise of an intranet authoring tool for the rest of us. Key new features include support for tables optimized for HTML, enhanced import capabilities for Microsoft Word documents, and OLE support so you can embed information directly from applications such as Microsoft Word and Excel into Trellix documents. Creating intranet content is made easier for those actually responsible for the information.

Trellix's Content Map now includes a "You Are Here" feature, which displays your current location within a document even when you're viewing it within a browser. The end result is a document that is professional-looking, well-organized, and easy to update and distribute. By taking a page from the Web, Trellix is pushing business communications beyond the ordinary office suite.

Trellix Inc., Waltham, MA; 781-788-9400; www.trellix.com.

WINNER

In Focus LP420, 425

This past year, business travelers welcomed an innovative product from In Focus Systems: A 6.8-pound Super VGA projector called the In Focus LP420 that is respectably bright (417 lumens; compares favorably with its 500 ANSI lumen rating), and is affordable. It boasts an excellent contrast ratio (181:1) and handles video extremely well. Later in the year, In Focus released the LP425, building on the LP420's appeal.

The In Focus LP420 was the lightest contender in this year's portable projector roundup (see our August 1998 issue), beating out its nearest competitor, the 9.5-pound Lightware MVP800, by nearly 3 pounds—an astounding feat for this type of peripheral.

The LP420 is based not on traditional LCD technology but on the Texas Instruments Digital Light Processing (DLP) system. The core of the DLP circuit board is the digital micromirror device (DMD), a modified CMOS chip covered with more than 500,000 microelectromechanical light-switch mirrors that cancel or reflect light. Each mirror is a scant 16 micrometers square and rotates in precise increments depending on the state of each memory bit that reaches the chip. Gray-scale images are produced by rotating these mirrors at high speeds; colors are produced by using a standard three-color wheel to illuminate the TI micromirror chip.

The LP420's illumination was a bit uneven when measured across the entire screen, and the unit isn't as feature-rich as some competitors (only one set of media jacks, no remote control or automated zoom). But it's one of the best projectors available today for the price and weight.

But In Focus didn't stop there. Since we reviewed the



LP420 in August, In Focus released the next generation, the LP425. Through technical innovation, In Focus boosted the system's ANSI lumen rating from 500 to 700 and maintained the projector's svelte 6.8-pound carry weight. The LP425's designers realized that adding a fourth, white segment to the standard three-color wheel would bathe the TI micromirror chip in white light directly from the projector's lamp, resulting in a free boost to brightness.

Like its predecessor, the LP425 delivered an impressive brightness score (662 lumens) as well as a respectable contrast ratio score of 183:1. It stumbled on our Brightness-Variance test, but you'll hardly notice this slight fault when you reach your destination and you're not hunched over from the pain inflicted by lugging around a 12-pound projector.

In Focus Systems Inc., Wilsonville, OR; 800-294-6400; www.infocus.com.

FINALISTS

U.are.U

You say you can never remember your password? Maybe you can remember to bring your finger. Equip your PC with the Digital Persona U.are.U, one of the first fingerprint-recognition devices, and it will be secure from prying eyes. Plus, your data can be encrypted for double protection.

We've seen many biometric devices come onto the market, including those for fingerprint detection, voice recognition, face recognition, iris detection, and signature recognition. U.are.U excels because it is easy to use, fast, and accurate. Its fingerprint recognition is almost instantaneous. You can hold your finger at different angles and the system still works.

The essential recognition process in U.are.U involves detecting the presence or absence of fingerprint ridges, dependent on the absorption or reflection of light when a user touches the reader's sensing area. For extra security, U.are.U's intelligent sensor alerts the host PC when an image is about to be sent, using a secure link based on a challenge-response mechanism that employs a one-time, random-number key. This prevents an unauthorized person from cutting the device cable and sending previously stored false data.

With U.are.U's One Touch Password feature, you can set up a password bank in an encrypted file that contains all the passwords you use to access applications, e-mail accounts, and e-commerce sites. The Deluxe version of U.are.U adds the Private Space feature, which creates a separate, secure partition on your hard disk. With its accurate fingerprint detection, support for multiple users (and multiple fingers for each user), password replacement, and responsible USB citizenry, U.are.U leads the field.

Digital Persona Inc., Redwood City, CA; 877-378-2738; www.digitalpersona.com.

Motorola

PageWriter 2000

The dynamic Motorola PageWriter 2000 two-way pocket pager is redefining mobile communications. A compact 7-ounce device that fits comfortably in a coat pocket or clipped to a belt, the PageWriter can both send and receive e-mail, and it keeps your messages organized.

Based on Motorola's own FLEX operating system, the PageWriter lets you receive news, weather, and sports from a variety of remote news sources. And thanks to the versatility of the FLEX OS, you can also download a number of applications, mostly PIM applets and games.

You can also set a range of timed alerts that are adjustable in type and volume, including low-battery alerts (there's a four-level battery power gauge that keeps track of your power). The readable backlit screen has 9 lines of 27 characters each, and the unit comes with 1MB of flash memory, plus 300K of static RAM. Each message can contain up to 300K of material. And finally, there's a miniature QWERTY keyboard and a joystick. In case you want to sync it with a PC for downloading data, the PageWriter has a built-in infrared port; the deluxe model includes a combination charger/docking station.

Perhaps the PageWriter's best innovation is its price: \$330 (street) for the standard version, \$360 (street) for the deluxe. Subscription to a service costs the same as normal guaranteed-message paging, which is generally less expensive than one-way paging or a cell phone. And it works almost everywhere in the U.S.

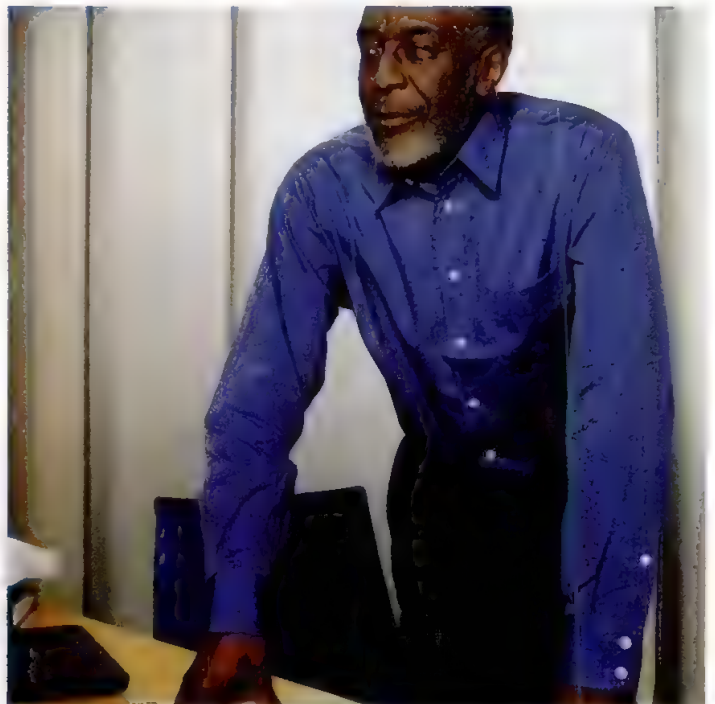
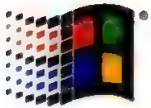
Motorola Inc., Boynton Beach, FL; 800-548-9954, ext. 2; www.motorola.com/pagers

Instinct may lead you to the right server OS. Or, you can always fall back on data, reason, and logic.

Microsoft® Windows NT® Server 4.0 was released two years ago. Today, 61% of networked companies in the U.S. are using it. And, Windows NT Server 4.0 currently outsells all other server operating systems. Why?

First, it covers the basics. Many companies choose Windows NT Server for great file and print. In fact, LAN administrators pick it 3 to 1 over NetWare for their basic LAN OS. But many companies also rely on Windows NT Server for much more than file and print. That's why it's called a multipurpose server OS, and why research shows that more companies choose it for their intranet platforms and commercial Internet platforms.

As you make your server OS decision, know that companies are choosing Windows NT Server because it handles basic networking and the ever-changing needs of today's business environment.



WINNER

IBM Deskstar 14GXP

Thanks to IBM's new giant magnetoresistive (GMR) head technology, there's a new standard for speed, capacity, and reliability in EIDE desktop storage. Hard disks incorporate more advanced technology of different varieties than any other component in the PC; every step forward requires serious advances in mechanics, chemistry, physics, and semiconductor electronics. The IBM Deskstar 14GXP is IBM at its best, pulling together the most sophisticated combination of class-leading technologies available in a consumer-level drive.

This new EIDE drive spins at 7,200 rpm, pumps data at Ultra DMA speeds (33 MBps maximum burst data transfer rate), and can store as much as 14.4GB of data. It boasts an average seek time of 9.1 ms, as well as a sustained data rate of up to 13 MBps. What really sets this drive apart, however, is the new GMR technology, which makes the heads more sensitive to magnetic fields from the disk.

To accomplish this, four magnetic layers in each head's sensor manipulate the quantum nature of electrons in the sensor itself. Electrons passing through the layers become oriented in directions relative to one another such that they develop a spin that's parallel to the disk's own magnetic orientation, thus reducing magnetic resistance that can cloud sensitivity. This increased sensitivity lets GMR heads detect smaller recorded bits than had previously been possible and to read those bits at higher data rates. Moreover, the larger signals of GMR heads let them overcome much of the electronic noise that plagues PC components. As a result, each of the Deskstar 14GXP's five platters holds 3.38GB; they are accessed using the drive's ten GMR data heads.



Other efficiency features include the standard high-end SMART (Self-Monitoring, Analysis, and Reporting Technology), which helps prevent data errors and increases reliability by keeping track of the drive's own gradual degradation, thus enabling the operating system to warn the user of potential disk failure.

Finally, the 14GXP uses IBM's TrueTrack Servo Technology. Over time, fast-spinning hard disks often suffer from constant spindle vibration and small shifts in disk position. To counteract this, IBM uses a high-gain peak filter in the servo system to cancel out periodic error signals due to the vibration and disk shift. The servo system is also adaptive: It relearns the vibration characteristics every time the drive is powered on and compensates accordingly.

IBM Storage Systems Division, San Jose, CA; 888-426-5214; www.storage.ibm.com.

FINALISTS

nVidia RIVA TNT

The latest accelerator chip from nVidia is the most impressive implementation of combined 2-D and 3-D performance we've seen. Capable of a near-complete range of 3-D effects and packed with impressive features, the RIVA TNT directly competes with the high-end speed of the 3Dfx Voodoo2 chip while also providing excellent 2-D performance. In our labs, we found that the RIVA TNT's reference drivers were the most stable of all the 2-D/3-D chips we reviewed—and it's the most popular high-end chip as well.

The RIVA TNT's 3-D capability comes from a 128-bit engine that processes 2 pixels per clock cycle and allows single-pass multitexturing or single-pass trilinear filtering with TNT's twin-textel 32-bit color pipeline. This 7-million-transistor chip lacks embedded DRAM, but it does include a small texture cache. It can run resolutions of up to 1,920 by 1,200 at true color with a 72-Hz refresh rate, and it fully supports Microsoft's DirectX 6.0 as well as OpenGL.

The RIVA TNT supports up to 16MB of either SDRAM or SGRAM, includes a 24-bit z-buffer and a 250-MHz RAMDAC, and performs full-scene anti-aliasing and per-pixel MIP mapping. The chip uses 8-bit stencil buffers, boasts 2X AGP functionality, and supports the NTSC and PAL standards for TV-out. Texture-blending capabilities include bump mapping (for showing 3-D lighting effects on surface textures), texture modulation, light maps, reflection maps, environmental maps, and procedural textures. The RIVA TNT also supports 32-bit textures. It does not, however, support 8-bit palette textures without workarounds, and it performed an excessive amount of texture loads and memory accesses on some of our texture-heavy tests.

nVidia Corp., Santa Clara, CA; 408-615-2500; www.nvidia.com.

NeoMagic

MagicMedia 256AV

The latest graphics accelerator from NeoMagic is the best on the market to date for performance notebooks. Used in the Gateway Solo 5150 Series, Sony VAIO PCG-808, Toshiba Tecra 8000, and a future IBM ThinkPad model, the NeoMagic MagicMedia 256AV is the new chip to beat. The only drawbacks: It's not a full-fledged 3-D accelerator, and it lacks a setup engine. But that functionality is less crucial in laptops; moreover, it's coming in a future chip. For today's performance notebooks, this is a terrific choice.

Not only is the MagicMedia the first 256-bit graphics chip for notebooks, it's also an AC97-compliant PCI/AGP audio chip with sample-rate conversion and a digital mixer. This 21-million-transistor chip has DVD-playback acceleration with motion compensation and includes 25MB of built-in SGRAM. It supports 1,024-by-768 resolution with true color yet consumes less than 1 watt of power.

The MagicMedia also supports two independent graphics displays, uses AGP for wavetable loads as well as graphics, has ZV support, a hardware video overlay, and x,y scaling. It employs a terrific new EMI-reduction technology called MagicPass (Peak Amplitude Spectral Suppression) which uses spread-spectrum technology to limit EMI peak frequencies and energy for the panel clock by spreading them over a wide frequency. Finally, the chip also supports multiple power modes and has a peak bandwidth of 3.2GB per second.

All in all, this is an exceptional graphics accelerator for power notebooks.
NeoMagic Corp., Santa Clara, CA; 408-988-7020; www.neomagic.com.

**With the right server OS, you can stay a step ahead.
With an industry of applications and support, you can
make it two steps.**

Over 4,000 applications are built to run on Microsoft Windows NT Server 4.0. That's a lot of options. And over 170,000 people have been certified to help you with Windows NT Server installation and service. Furthermore, every major OEM is building solutions around Windows NT Server. So you can choose from a wider variety of hardware.

If you choose Windows NT Server 4.0, you're choosing to keep your software and hardware options open. You're also choosing an industry of support to help you solve today's problems, and to help you think about tomorrow's.



WINNER

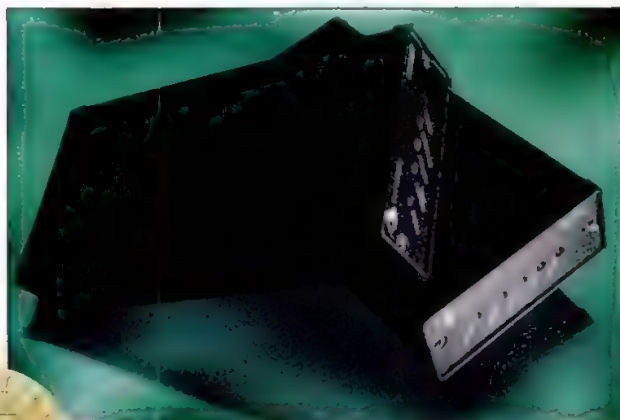
Tut HomeRun Network Interface Card

Much of the technical excellence we see is derived from innovation, but that's far from the final word. In the networking and communications markets, things must work together. Most networking vendors follow the standards route. Companies such as Intel and 3Com push standards through international committees, and those standards eventually lead to new products. But that route takes a lot of resources—something small companies don't have.

If you've got the talent, though, there's another way. You can, indeed, come up with an innovative technology and prove it is so good that bigger companies will want to license it. That's how a small company called Tut Systems brought the Tut HomeRun Network Interface Card to market in time for Christmas 1998.

After years of developing technologies to send data faster, farther, and more reliably over copper wire, Tut Systems has developed a way to network—over existing home telephone wiring—that has the interest of the industry's giants. AMD, Intel, Lucent, National Semiconductor, and Rockwell are all integrating Tut's technology into chip sets, and companies such as Compaq and 3Com have purchased licenses.

Networking the home office and branch office is a big business, but network cabling remains a big barrier. Tut's HomeRun solves the problems of making holes and pulling cable. HomeRun piggybacks a network signal over existing telephone wires using a high-frequency signal that telephones can't detect. The signal doesn't interfere with the normal operation of your telephone or fax. The telephone wires do double-duty as network cabling.



The PC sees the Tut device as a network adapter. Because HomeRun provides a standard 10Base-T connection, you can network virtually anything that uses Ethernet, including network printers. We tested the HomeRun with a variety of PCs, a Macintosh, and an HP network printer, and the device performed flawlessly. The 1-Mbps throughput is fast enough for sharing access to printers, data, or 56-Kbps Internet access. And you can network as many as 25 PCs and other devices up to a distance of 500 feet.

Tut gives you flexibility, too. The internal version of the HomeRun card combines an Ethernet port and a HomeRun port, whereas the external version connects to an Ethernet card in the PC. On the telephone side, a pass-through phone connector eliminates the need for phone line splitters.

Tut Systems Inc., Pleasant Hill, CA; 800-684-2014, 925-682-6510; www.tutsys.com.

FINALISTS

Citrix MetaFrame

The concept of an inexpensive network computer (NC) soared into the headlines, ignited an explosion of interest, and died when it met the low-cost PC. In its flight, however, it legitimized and refined one outstanding and technically innovative product from Citrix and led eventually to Citrix MetaFrame.

Citrix WinFrame, based on the Microsoft Windows NT 3.51 kernel, offered thin client computing with all of its benefits—such as close control of the desktop and centralized resource management. But WinFrame was a little too different and too proprietary to find huge success.

In the glow of the NC bonfire, Citrix got Microsoft's attention. The two companies developed the Microsoft Terminal Server—a thin client system on the Citrix model. But Microsoft was interested only in the Windows architecture, and Terminal Server leaves all other clients out in the cold. Citrix extended the environment across Macintoshes, OS/2, many flavors of Unix, wireless devices, and other systems with MetaFrame. The company overcame many technical challenges to provide people using these environments with access to Windows applications.

MetaFrame offers seamless integration to the client system. It gives you access to all of the local systems' resources, so it feels like the applications are running locally rather than remotely. Several management tools let you configure, manage, and update multiple MetaFrame servers and clients across the enterprise from a single seat. Citrix also has a load-balancing feature for multiple MetaFrame servers and a Secure ICA encryption option.

Citrix Systems Inc., Fort Lauderdale, FL; 800-393-1888, 954-267-3000; www.citrix.com.

RadioLAN

You only get what you pay for, and speed always takes a premium. Wireless networking is a good solution for some tough installation problems. But wireless systems typically move data only at 1 to 2 Mbps—potentially creating a bottleneck that affects the whole network.

RadioLAN pushes the radio frequency, the technology, and the throughput to new limits. RadioLAN gives you a wireless LAN connection at 10 Mbps over more than a 100-foot radius. Plus, you can set up as many as 128 nodes and connect to existing 10 Base-T Ethernet networks using the Backbone LINK wireless hub (\$1,000 list). In addition to the PC NICs, there's a \$449 PC Card NIC for portable users—if it solves your problem, it's worth every nickel. At \$349 (list) each, a RadioLAN adapters costs three to four times as much as an Ethernet card (remember what we said up top), but the adapter's value is clear. Many small-office users will likely find the initial trade-off in cost and installation time well worth the payoff in convenience, flexibility, and of course, speed.

To be sure, engineering consumer products for the 5.9-GHz band poses unique problems. But this band allows for wider bandwidth, freedom from interference, and fewer objections from people worried about the biological effects of radio systems. RadioLAN overcame the engineering obstacles and delivered systems using two receivers to overcome signal problems. Our hands-on tests showed sustained throughput of nearly 6 Mbps in a typical environment. The product works on both NetWare and Windows LANs.

RadioLAN met engineering challenges, broke new ground, and offers a flexible and capable solution to unique networking problems.

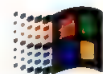
RadioLAN, Sunnyvale, CA; 888-272-3465, 408-616-6300; www.radiolan.com.



What's more important: the present or the future?

Both. The companies and partners who support Microsoft Windows NT Server 4.0 are integral to the development of Windows 2000 Server. So if you base today's solution around Windows NT Server, you'll have a solid migration path for both your network and your applications. And you'll know that the industry you are counting on will be with you down the line.

As you take the time to make your server OS decision, you may want more detailed information. We've assembled some new resources for you at the Web address below.



**Windows NT[®]
Server 4.0**

www.microsoft.com/go/WindowsNTServer/

Microsoft

Where do you want to go today?®

Sources: US networked use and sales run rate: Sofres Intersearch Network Operating System Share Study, 1998. LAN administrator preference: ZD Market Intelligence, September, 1998. Most popular commercial Internet platform for self-hosted companies: Netcraft Web Server Survey, 10/98. Most popular intranet platform: Zone Research, Inc., "Internet and Intranet: 1998 Markets, Opportunities, and Trends."

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WINNER

ASF Digital ICE and Nikon Super Coolscan 2000

Scanning film should be a trouble-free process. But all too often, dirty negatives and transparencies require touching up in an image editor such as Adobe Photoshop before they are usable. Applied Science Fiction's Digital ICE virtually eliminates this tedious step through an ingenious combination of hardware and firmware. Installed in the Nikon Super Coolscan 2000, Digital ICE instantly raised the bar for all other film scanners.

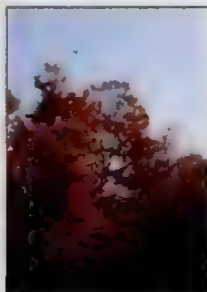
In addition to the traditional process of scanning the blue, green, and red layers of color film, Digital ICE adds a

fourth pass to scan the surface layer of the film. Specifically, it maps scratches, hairs, dirt, stains, and most other surface blemishes as defects and subtracts them from the final color scan. Because it looks at the physical surface rather than the image itself, Digital ICE can easily distinguish between an eyebrow hair that fell on the film and a close-up of a person's eyebrows.

The Nikon Super Coolscan 2000 is the first product to incorporate Digital ICE technology. Fast, quiet, and versatile, it handles both 35-mm film and the new Advanced Photo System film cassettes.

Applied Science Fiction, Austin, TX;
512-651-6200; www.appliedsciencefiction.com.

Nikon Inc., Melville, NY; 800-526-4566; www.nikonusa.com.



FINALISTS

Epson Stylus Photo EX

A versatile, large-format, high-quality photo printer, the Epson Stylus Photo EX prints text, graphics, and realistic photos on standard- and tabloid-size paper at resolutions as high as 1,440 by 720 dpi. A child of Epson's second generation of photo-centric printing, it showed the best combination of image smoothness, realistic colors, and accurate detail without posterization, and it's even marginally faster than the competition.

In our labs, the Photo EX even managed to portray depth in photos, an area in which other printers were lacking. In a close-up shot of the face of a dog, the Photo EX clearly showed detail in the dog's dark eyes. Though competition is steep, if you're looking for rich and vivid photo output, you can't beat this fine printer.

Epson America Inc., Torrance, CA; 800-463-7766; www.epson.com.

Kodak DCS 520

For many, the Kodak Professional DCS 520 is the first digital camera that shoots like the leading 35-mm film cameras. Developed in partnership between Eastman Kodak and Canon U.S.A., the DCS 520 not only affords extraordinary image quality but also augments its central camera with several new hardware and software tools.

With an ISO range of 200 to 1,600 and a capture rate near 3.5 images per second, it grabs multiple, high-quality images indoors or out. Each image displays instantly on the camera's LCD screen, where a unique highlight feature describes pixel quality. You can tag the images with voice annotations via the built-in microphone. You can then download images to a PC Card or connect over FireWire to transfer images rapidly to your PC. **Eastman Kodak, Rochester, NY;** 888-375-6325, 716-726-7260; www.kodak.com.

WINNER

XML: Extensible Markup Language

The Web was built on HTML, but it likely will be rebuilt on XML. HTML gave Web page creators a rich language for defining the layout of text and graphics on a page. Yet HTML cannot describe the actual contents of a page—what the page is actually about. XML describes the nature of the content itself and therefore should revolutionize the way we share and search data.

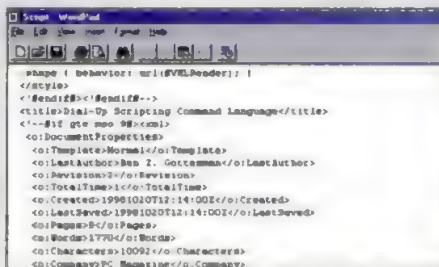
Like HTML, XML grew out of SGML, the metalanguage developed in the mid-1980s. But whereas HTML is a specific, limited instance of SGML, XML is a metalanguage in itself. It is nonetheless relatively simple.

Like its predecessors, XML uses

markup tags to describe the contents of virtually any type of file, such as a Web document, a spreadsheet or graphic, or a set of database records. The thirst for a language to describe data is easily evidenced by the number of XML-based languages that have popped up since the W3C started work on XML two years ago. These include languages for financial transactions (OFX), vector graphics and multimedia (VML and SMIL), Web site ratings (RDF), and syndication of content (ICE).

Most users first experienced XML in action in the Channel Definition Format, used in Microsoft Internet Explorer 4.0. XML will soon be even more in the mainstream with the impending release of Microsoft Office 2000.

XML, www.w3.org/XML/.



FINALISTS

IEEE 802.3z: Gigabit Ethernet

To satisfy our networks' insatiable hunger for bandwidth, the Gigabit Ethernet specification delivers a quantum-leap improvement, offering data transfer of 1 gigabit per second (that's 1 billion bits per second)—100 times that of traditional Ethernet. Gigabit Ethernet delivers this capacity for bandwidth-starved servers and the backbone infrastructures of corporate and educational communication networks. The IEEE ratified the standard in record time; the move was hastened by the cooperation of the consortium of vendors that make up the Gigabit Ethernet Alliance.

IEEE 802.3z is a logical step forward from 10-Mbps and 100-Mbps Ethernet. It requires no change in networking operating systems, protocols, or applications.

IEEE 802.3z, grouper.ieee.org/groups/802/3/z/public/index.html.

IPSec: Internet Protocol Security

Virtual private networks (VPNs) are all the rage for connecting business partners, remote locations, and road warriors using inexpensive routes over the Internet. This is possible, though, only because the emerging IPSec standard, from the Internet Engineering Task Force, makes security and interoperability possible. Deployed for a VPN, IPSec lets equipment and software from disparate vendors create secure connections for traffic between two end points—as though they were part of the same physical network, even though they are geographically dispersed.

The protocol allows for defense against intruders and data privacy, with authentication and encryption.

IPSec, www.ietf.org/html.charters/ipsec-charter.html.



It is a machine.

It is an extension of yourself.

It allows you to walk.

It allows you to run.

Occasionally, it allows you to leap.

www.hp.com/kayak

*1 IN HIGH-PERFORMANCE PC WORKSTATIONS



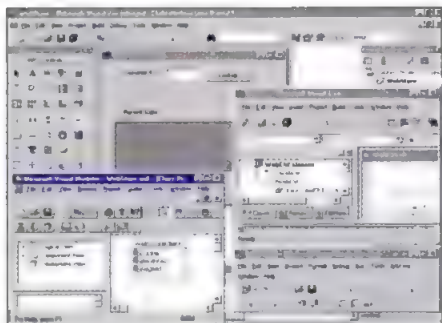
WINNER

Microsoft Visual Studio 6.0

The release of Microsoft Visual Studio 6.0 Enterprise Edition brought significant new technology and tools to an already popular bundle of language tools. Its enhancements extend the reach of Microsoft's Distributed Component Object Model (DCOM) and ensure that developers can be more productive than ever.

The new Visual C++ supports on-the-fly code changes during debugging—a big leap forward. Version 6.0 also provides better support for Active Template Library COM controls.

Visual Basic 6.0 makes it easier to



design objects that work in traditional client/server settings, as well as remote objects that run on the server using DCOM. The new Visual J++ turns Java into a powerful Windows and ActiveX development tool. The new Visual InterDev offers visual design capabilities for Active Server Pages development. Microsoft's new wizard technology IntelliSense makes it easier than ever to write and maintain code, with auto-completion wizards and instant pop-up help for all objects as you type.

The new Visual Studio is a cutting-edge suite that likely will change the way developers do development.

Microsoft Corp., Redmond, WA; 425-882-8080; msdn.microsoft.com/vstudio.

FINALISTS

Perl 5.005

Long before Linux became the open-source poster child, Perl was helping developers change the World Wide Web from a static document database into a dynamic application interface. Perl is the mature system-administration language that became the CGI platform of choice, because it is powerful and open—and available on just about any platform.

Perl 5.005 has modern programming facilities, such as modules and objects, and a unified code base, including both the Unix and Win32 versions. On the Web you can find a Perl module to do just about anything, and it will be free and include the source code. Perl programmers are thankful to Larry Wall, the father of Perl; to an army of Perl-hacking volunteers; and to vendors such as ActiveState and O'Reilly & Associates.

www.perl.org.

Microsoft Developer Network

If you develop for Microsoft Windows 95, 98, or NT using any of Microsoft's visual tools, the Microsoft Developer Network (MSDN) subscription is a must-have. From service patches for Windows NT to workarounds for obscure ODBC error messages, the MSDN provides sample code, product documentation, technical articles, tips, and tricks.

You can search the MSDN library by keyword, product, type of article, or custom subset. The MSDN subscription is delivered four times a year, with updates as they are released. The entry-level Library subscription provides basic support. The high-end Universal subscription brings you the latest developer versions of the Back Office test platform; all Microsoft OSs, including debug versions; and Visual Studio 6.0 Enterprise Edition.

Microsoft Corp., Pleasanton, CA; 800-759-5474; msdn.microsoft.com/developer/default.htm.

WINNER

LEGO MindStorms Robotics Invention System

Imagine if all those LEGO robots and assorted vehicles you built as a child could come to life and follow your instructions. LEGO made it so this past year with LEGO MindStorms Robotics Invention System, which combines LEGO building bricks with a programmable microcomputer. You can create robots that follow specified trails or detect changes in light and temperature.

The MindStorms kit comes with more than 700 LEGO pieces, one light sensor, two motors, an infrared transmitter, and the programming software. The system runs on



the RCX, an 8-bit microprocessor with 16K of ROM, 512 bytes of SRAM for firmware, and 32K of external SRAM for user code and other applications.

Creating a robot that will do what you want is a three-step process. First you build something with the LEGOs—say, a crane that can lift things, then use the software to program your creation. After you download the instructions from the PC via the infrared transmitter, the robot is ready to go.

To get you started in the building and programming process, MindStorms includes comprehensive training sessions in which the concepts of logic and design are explained and illustrated.

LEGO Group, Enfield, CT; 800-243-4870; www.legomindstorms.com.

FINALISTS

Quake II

There's no question about it: Quake II is one of the best action games ever created (as rabid fans around the world will attest). Though the plot of this first-person shoot-'em-up isn't epic—you play a lone marine battling against an evil alien race called Strogg—the game play is outstanding. Kudos again to id Software for moving games forward technically.

The game has spawned a slew of imitators. After its release, other game developers immediately started producing games based on the Quake II graphics engine. And the reason is obvious: The colored lighting, dynamic light sourcing, and level of quality design had never been seen before in an action game.

It's games like Quake II that push the envelope and bring gaming to the next level. **id Software/Activision**, Mesquite, TX; 800-477-3650; www.idsoftware.com.

Microsoft SideWinder Freestyle Pro

A long time ago, you controlled the action of your PC game using your keyboard.

The mouse, game pad, and joystick were definite improvements. Don't look now, though. The Microsoft SideWinder Freestyle Pro is a quantum leap forward. Although it resembles a traditional game pad somewhat, the similarity ends there. This device also lets you control your movement within a game by tilting the controller left, right, up, or down.

Able to work with either your game port or USB, the Freestyle Pro features both analog and digital controls in addition to the motion sensory technology. The sensitivity and range of the motion sensor are completely adjustable. Action games, racing simulators—just about any type of game you can think of—simply become more fun to play. **Microsoft Corp.**, Redmond, WA; 800-428-9400; www.microsoft.com.

We can't say what applications she'll be using in five years.

We can, however, predict the monitor.



Business goes out of date. CPUs are superseded.

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	MultiSync E500+	MultiSync E750+	MultiSync E900+	MultiSync E1100+
Viewable Image Area	13.3"	14.5"	15.5"	17.0"
Panel	GlareClear™	GlareClear™	Microfilm™ Dot-Free	Microfilm™ Dot-Free
Depth	3.25mm max.	3.5mm max.	0.26mm dot 0.22mm horizontal	0.26mm dot 0.24mm horizontal
Maximum Resolution	1280 x 1024 @ 60Hz	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz	1600 x 1200 @ 75Hz

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Technical Excellence Awards

WINNER

Dr. Tim Berners-Lee

Would you say that inventing the World Wide Web was a significant achievement? We certainly would, and that's why this year, we're honoring the man who came up with the idea. Dr. Tim Berners-Lee couldn't have known ten years ago that his clever little notion would evolve into a technology that would help tens of millions of people communicate every day, reinvent publishing, transform traditional business practices, and change the way we shop forever. All he wanted to do was share charts and graphs with other scientists.

Educated at Queen's College at Oxford, Berners-Lee, 43, had a varied high-tech career until he landed as a consulting software engineer at CERN, the European Laboratory for Particle Physics, in Geneva. While there, he wrote, for his own use, a program called Enquire, which stored information using random associations. Never published, Enquire was the first spark of big things to come.

In 1989, Berners-Lee proposed a global hypertext project to be known as the World Wide Web. It wasn't designed to sell cars or to deliver news headlines but rather to allow people to work together by combining their knowledge in a web of hypertext documents. He wrote the first Web server and the first client, a WYSIWYG browser, in the NeXTStep en-

vironment. The program "WorldWideWeb" first became available within CERN in December 1990, and in the summer of 1991, it appeared on the Internet.

At that point, Berners-Lee's work had really just begun. Over the next few years, he worked out specifications for HTTP, URLs, and HTML so that the Web would be usable by the general public. In 1994, when easy-to-use browsers

became available to the masses, Berners-Lee moved on to the Laboratory for Computer Science at MIT, where he remains today as director of the influential World Wide Web Consortium—the organization that coordinates Web development all around the world.

Despite the Web's unbelievable sprawl, Berners-Lee has managed to remain at the center of the most important technological debates about its future. That has helped to ensure the kind of progress we've all enjoyed over the

past four years. We can only imagine how much bigger his simple little idea will become in the years ahead.

Berners-Lee is the recipient of three honorary degrees and numerous awards, and this year, he was awarded a prestigious MacArthur Fellowship award. For the incredible work he has already done, and in anticipation of the work we look forward to seeing in the future, we honor Dr. Tim Berners-Lee with our 1998 award for Lifetime Achievement.



WINNER

Jerry Yang and David Filo

Just one year ago, very few people had ever heard the phrase "Web portal." Today, more than a dozen portals are waging a bloody battle not only for your eyeballs but also for mind share among the millions of people who are still new to cyberspace.

Look at what happened in 1998: NBC struck a deal with Snap. Lycos acquired Wired Digital. AltaVista added channels. Disney bought into Infoseek. Netscape relaunched its Netcenter. And Microsoft consolidated its online efforts into msn.com.

Why all the frantic deal-making and redesigning? Because everyone wants to mirror the success of the Web's largest and most successful portal: Yahoo!

Created on a whim in April 1994 by Stanford grad students Jerry Yang and David Filo, the Yahoo! directory was there when the Web had only a few hundred sites. "Yahoo!" soon became synonymous with "finding it on the Web." As their project grew from a hobby into a business, Yang and Filo demonstrated both marketing and technological prowess, simultaneously building a powerful brand while scaling the site to meet the needs of an

audience that grew exponentially as the months raced by. After a solid IPO, Yang and Filo were sitting on something huge, and their would-be competitors couldn't help but notice.

Yang, 30, and Filo, 32, are nothing if not competitive, however, and they've expanded Yahoo!'s services at a breakneck pace, transforming it from a simple directory into a full-

featured one-stop Web service center that can occupy its visitors for an entire day.

This year alone, Yahoo! has added auction services, a gaming hub, instant messaging, Internet telephony, and hundreds of special-interest clubs. The site is even offering Internet access and marketing its own Visa card. The ultimate goal: to make

Yahoo! your one and only home on the Web.

With the "grown-up" guidance of CEO Tim Koogle and COO Jeffrey Mallett steering them to new levels of success, Yang and Filo are free to preside over their \$11 billion company with the somewhat whimsical but deadly serious titles of Chief Yahoos. There's no doubt: 1998 was the year of the portal, and the portal of the year was Yahoo! Congratulations to Jerry Yang and David Filo, as our People of the Year. **PC**



Yang



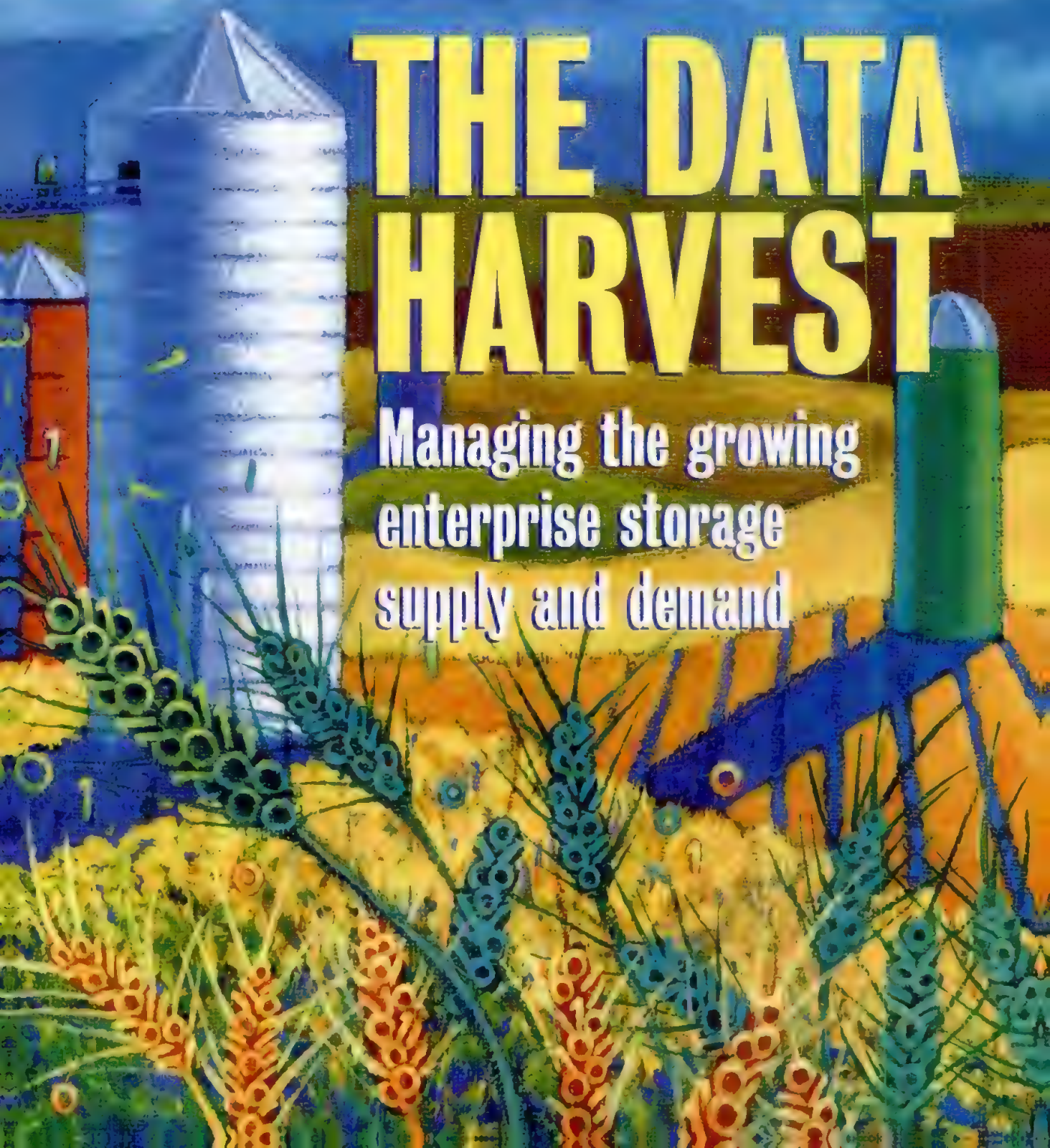
Filo



IT Outlook

THE DATA HARVEST

Managing the growing
enterprise storage
supply and demand



Managing Storage Silos

Increased capacities, lower prices bring about a data storage revolution

BY BOB FRANCIS, PC WEEK

FOR MUCH OF THE PAST decade, the trend in enterprise storage has been to farm data out to the servers where that data is created. But that trend is reversing rapidly as storage needs increase exponentially, clogging up already choked networks.

In response, IT managers are taking a fresh look at how to manage their storage needs. High-speed Fibre Channel storage devices and new network designs are key components in this new world of storage. In addition, IT shops have increased their storage investment. According to Dataquest Inc., based in San Jose, Calif., 35 percent of IT dollars are now being spent on storage, as opposed to 30 percent in 1994. Those storage dollars are buying more capacity: The money that bought 40MB of storage in 1990 now buys 8GB. However, that only makes the job of managing that data more complex.

Back to the future

As a result, IT managers are seeking ways to get the most for their storage dollars. One key method is centralization.

That's certainly the case at Blue Cross/Blue Shield of Georgia. The Columbus, Ga., company is developing plans for more centralized storage and quicker access to stored data. "There's an explosion of data out there," said Dave Kannady, lead network communications analyst at the insurance company. As a stopgap measure, Blue Cross/Blue Shield has moved to faster high-end SCSI storage systems, which have offloaded storage processing from its Windows NT servers. That means the compa-

ny can add storage at random without disrupting the network. "When the storage was on the server, we'd have to take down Windows NT, install or upgrade our drives, and then bring the system back up, and that's not really practical," Kannady said.

Blue Cross/Blue Shield has about 50 Artecon Inc. SuperFlex DGR 3000 systems, totaling about 500GB, attached to its 50 servers scattered around its statewide network. Those new devices have alleviated bottlenecks at the server level and increased server productivity, but Kannady would like to do more. "Our servers and our network are much more stable now. Our next move will be to install a storage area network so that our storage will be independent of the servers," he said.

Kannady may be a typical IT manager as far as storage is concerned. He wants a simplified network to track and manage storage levels but also a network that provides fast data access as well as the ability to add more storage devices at will. That means storage is not just a capacity game anymore, although capacity is still important. Most industry analysts expect storage capacity requirements to continue increasing as much as 50 percent per year.

More critical than ever are speed, reliability and management, a trend supported by recent acquisitions. Storage giant EMC Corp. earlier this year purchased Conley Corp., a \$6 million vendor of data management tools for Unix and Windows NT servers. And although Compaq Computer Corp.'s purchase of Digital Equipment Corp. was not built around the combining of storage resources, that blend has been an asset. The combined company now has 22.6 percent of the open stor-

age market, making it the market leader. It is followed by IBM, with 14.3 percent of the market, and EMC, at 11.6 percent, according to International Data Corp., based in Framingham, Mass. Veritas Software Corp., a storage management software provider, recently purchased Seagate Technology Inc.'s storage software unit, giving it access to Seagate's NT storage expertise.

Looking to new storage techniques

Storage is an area where IT managers are struggling to put the genie back in the bottle, said Michael Peterson, president of Strategic Research Corp., in Santa Barbara, Calif. "With distributed computing, storage moved from the mainframe out to the desktop. Then IT decided to centralize it at the server. But

That, along with growing traditional applications, such as e-mail, tax corporations' storage resources, he said.

In an attempt to take back ground lost to decentralization, IT managers have adopted several new storage technologies, including SANs (storage area networks) and NAS (network-attached storage) to serve current storage needs (see stories, right and Page 4).

NAS is available now, and many users have installed some version of the technology. A NAS device is a specialized server that does nothing but hold files for use on the network. However, NAS is not always advantageous for database applications because it is file-oriented. NAS does work



now, with the growth of enterprise applications, that data needs to be accessed by the whole corporation," Peterson said.

Enterprise applications that are feeding this storage frenzy include the Internet, data depots, data warehouses and ERP (enterprise resource planning) applications.

well, however, for document and knowledge management applications. Because it does nothing but hold files for the network, NAS is flexible, but at peak times, network slowdowns may cause it to be inefficient.

NAS devices work well for
CONTINUED ON PAGE 10 ►

Leave the Simple Services To Network-Attached Storage

BY HENRY RALTAZAR, PC WEEK LABS

NAS DEVICES DELIVER AFFORDABLE, high-performance file storage that can satisfy even the most voracious data appetite.

Over the past year, network-attached storage devices have evolved from quick-fix storage solutions to critical network components.

NAS devices are essentially stripped-down servers specifically designed for file services—sending, receiving and storing data files. Storage capacity ranges from 8GB to 1.4 terabytes, with prices ranging from \$3,000 to \$150,000, depending on processing power and storage capacity.

The most compelling reason to buy a NAS device is to offload simple file services from more

as databases and Web servers.

Weighing in the high prices of today's enterprise-class Xeon-based servers, and the fact that the larger Level 2 cache found on expensive Xeon Pentium II processors won't dramatically boost file

transfer performance, it seems ludicrous to waste valuable processor cycles on simple file services.

NAS to the rescue

NAS products come in all shapes and sizes—from Meridian Data Inc.'s 18GB Snap Server to the awe-inspiring F700 series from Network Appliance Inc., which ranges in size from 50GB to 1.4 terabytes.

NAS devices deliver file-sharing services comparable with, and at times better than, traditional network servers. The low-end models, however, are best suited for workgroup environments because they lack the processing power for larger environments. For example, Procom Technology Inc.'s NetForce can manage up to 80GB of storage and includes RAID Level 5 for fault tolerance. Its on-board Pentium-class processor would have barely enough horsepower to boot up a typical Windows NT 4.0 server, however.

All NAS units are shipped with their own proprietary operating systems. This bundled software helps to keep costs down, because it eliminates the need to purchase additional

Why NAS?

- ▶ Easily installed without any server downtime
- ▶ Frees up processing power for mission-critical applications
- ▶ Wide variety of NAS products available to satisfy virtually every organization

Windows NT or NetWare server licenses. The NAS operating system is fully compatible with all server operating systems, including NT, NetWare and Unix.

On the high-end NAS level, Network Appliance's F700 series

delivers technology and performance capabilities that put even the most powerful Intel Corp. servers to shame. The cutting-edge F700 ships with Fibre Channel disks and gigabit interface cards as standard equipment (see PC Week, Oct. 19, Page 65).

Perhaps even more impressive than the F700's top-of-the-line hardware are its innovative software features—for example, the innovative Write Anywhere File Layout system and the software's ability to control opportunistic locking on a directory level.

Plug-and-play installation

Moreover, NAS units are relatively easy to set up and flexible enough to fill a wide variety of needs for virtually any organization.

Before NAS devices came to market, IT managers who needed to expand network storage capacity had to either connect an external storage array to an existing server or purchase a new server.

NAS turns painful storage upgrades into a plug-and-play affair requiring no server downtime or lost weekends reconfiguring and

CONTINUED ON PAGE 19 ▶

EDITOR'S NOTE

I'll never forget how envious we all were 14 years ago when PC Week's then editor in chief received a new IBM PC/AT with a 20MB hard drive.

Every reporter in the newsroom was in awe—imagine, never running out of storage space and not having to rely on 5.25-inch floppies. Our dual-floppy 8086 PCs began losing luster.

Fast forward to today. What it cost to buy 40MB of storage in 1990 now buys 8GB. The price is right, but even 8GB nowadays can be insufficient. Technological advances have made terabyte capacity noninspiring—it's an affordable necessity.

The challenge today is managing the volumes of data. It's time to clean house—to figure out what data stays, what goes and how to best use network resources.

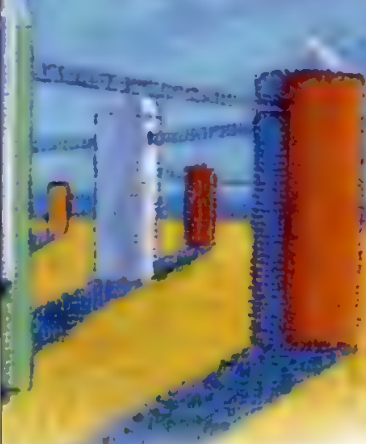
In this edition of IT Outlook, we look at these options. Network-attached storage is a sure bet to offload basic file storage and retrieval from pricey server hardware (see story, at left). Storage area networks and Fibre Channel products will soon be ready for prime time, as will enterprise storage management solutions (see stories, pages 4 and 17).

In addition, you should watch out for the next round of data sponges—14GB notebooks and 200MB-plus options for handheld PCs and digital cameras (see story, Page 15).

Now's the time to harvest your data to further cultivate your enterprise storage process.

Linda Bridges

Senior Executive Editor, PC Week



expensive application servers. In other words, why waste heavy-duty iron on tasks that can be handled by less expensive hardware? By switching data storage chores to NAS devices, companies make more horsepower available for general-purpose servers to run applications such

A Glimpse Into SANs' Future

BY HENRY BALTAZAR, PC WEEK LABS

STORAGE AREA NETWORKS—or SANs—have the potential to create a vast, efficient network of data storage, unencumbered by current networking media. Holding up the process, however, are underwhelming management and fault tolerance capabilities and a scarcity of optimized applications.

SANs will eventually be at the core of every enterprise-class data center, allowing companies to design centrally managed data storage centers that can provide services to all servers, regardless of the operating system they are running. Database and operating system vendors will be able to take advantage of high-speed SAN links to provide clustering with performance scalability and fault tolerance.

SANs are not new to mainframe data centers, which have been using standards such as IBM's Serial Storage Architecture for years. The emergence of Fibre Channel for distributed systems is making SANs viable on WAN and LAN infrastructures.

However, the SAN technology available today provides an improved server interconnect to replace SCSI (see story, Page 17), but it doesn't deliver on all of SAN's promises.

The benefits of SAN

The dearth of practical server interconnects for distributed systems is a problem that plagues most IT departments. To bind distant servers, administrators are forced to use Fast Ethernet links, which are incredibly inefficient because of packet overhead and high latency. For small, computer room environments, short, unwieldy SCSI interconnects are used to link servers and external storage devices.

The outlook is promising, but it's hindered by a lack of applications and subpar management abilities

Administrators who adopt SAN technology can create a separate network infrastructure, typically consisting of a Fibre Channel Arbitrated Loop, to relieve the high-bandwidth burden created by server-to-server communication on corporate network infrastructures.

Fibre Channel and Virtual In-

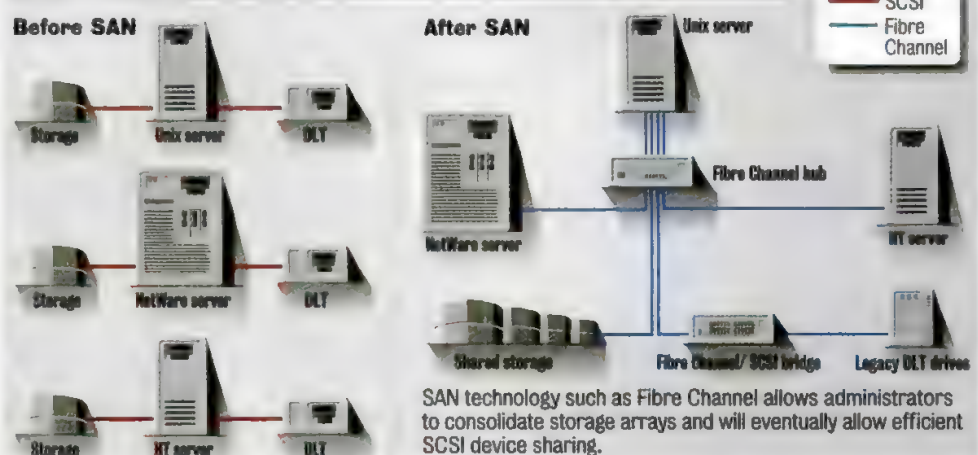
puts such as Compaq Computer Corp.'s Fibre Channel Storage Array (see review at www.zdnet.com/pcweek/reviews/0216/16cpq.html) allowed the sharing of external disk storage devices with servers, providing a central point of administration.

Interoperability should improve with the introduction of Fibre

brary Option (released last month) will allow administrators to share SCSI-based tape and optical libraries among multiple servers, regardless of hardware platform and network operating system differences. ARCserveIT not only can move massive bandwidth consumption from LANs to SANs but also allows administrators to stream multiple backups to high-performance tape drives, ensuring that drives are pushed to their limits.

However, ARCserveIT won't have adequate hardware support

Storage-attached networks at work



terface Architecture, a SAN interconnect that is further away from being implemented (see PC Week Labs' Tech Analysis of the latter option at www.zdnet.com/pcweek/reviews/0608/08vi.html), have the potential to allow significantly longer cable lengths than SCSI, so servers in different buildings can share external devices. And because these SAN interconnects have low latency and less overhead than WAN and LAN networks, they are better suited to bandwidth-intensive activities such as disk mirroring and clustering.

In PC Week Labs' tests, prod-

Channel/SCSI bridge products (expected in the first quarter of next year), which will make it possible to add legacy SCSI products to Fibre Channel SANs. Considering that most vendors won't have Fibre Channel-attached tape storage devices for at least a year, bridge products will be the catalysts for SAN growth.

And although there are no applications optimized for SANs, there are packages that take advantage of the technology.

For example, backup software packages such as Computer Associates International Inc.'s ARCserveIT with the Enterprise Li-

for at least a few months.

There are many benefits to implementing SAN technology now, but the absence of SAN-optimized applications as well as manageability and interoperability concerns mean administrators should proceed with caution.

SANs also need to be beefed up in the areas of network management utilities and fault tolerance. Considering the devastating consequences of a downed SAN component, the ability to quickly detect and react to network failures cannot be understated.

CONTINUED ON PAGE 19 ►

FYI



Every year, the amount
of data you store doubles.



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**If you use the Internet, it
doubles every six months.**

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The background is a dark, textured surface with a pattern of binary code (0s and 1s) scattered across it. Several bright, white, diagonal lines cut across the image, creating a sense of depth and movement. The overall aesthetic is high-tech and futuristic.

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enterprise information into a continuous
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STORAGE NETWORKING

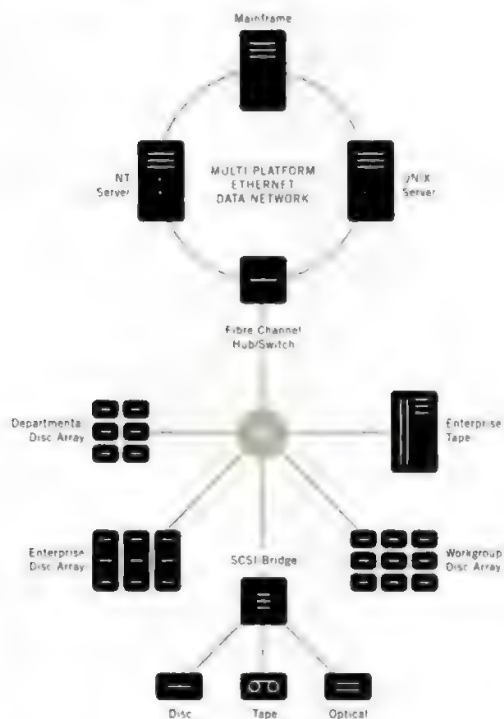


fig. 1

A STRATEGIC LOOK

FYI

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Drive Capacities Spiraling

Desktop storage will soon reach 20GB; portables will reach 14GB

BY JOHN G. SPOONER, PC WEEK

THESE DAYS, THERE'S A disk drive for everybody. Capacity continues to increase while prices decrease, thanks to a slew of vendors developing and implementing new methods of storage.

New technologies allow users of handhelds and digital cameras to store greater amounts of data on smaller, more durable media, while traditional hard drive makers such as IBM's Storage Systems Division, Fujitsu Computer Products of America Inc., Western Digital Corp. and Seagate Technology Inc. have steadily increased the capacity of their hard drives for desktop PCs, notebooks and servers.

This increase in capacity has effected a sharp decline in the price per megabyte of hard drives during the last 10 years: from \$11.54 in 1988 to about 10 cents in 1997 to 5 cents by the end of this year, said Jim Porter, president of Disk/Trend Inc., a Mountain View, Calif., consultancy that tracks storage technology.

Porter added that, by the end of this year, disk drive capacities will reach as high as 50GB for servers, 20GB on the desktop and 14GB in notebooks, thanks to introductions by vendors this fall of the largest-capacity drives ever.

For example, IBM's Storage Systems Division, in San Jose, Calif., will introduce several desk-

top and mobile drives. IBM drives are expected to reach 20GB capacity on the desktop and, with its new Travelstar 14GS drive, 14.1GB for notebooks. IBM will also introduce a new slim-form-factor 6.4GB Travelstar6GN hard drive for notebooks, measuring 9.5-mm thick.

For its part, Fujitsu last month announced 19 hard drives for servers, desktops and notebooks. It has doubled its high-end drive capacity year over year by increasing areal density—the amount of data per square inch on a hard drive platter—from about 2GB to 4.55GB per disk platter. Hard drives are constructed using platters.

The San Jose company has also migrated its drives to more sensitive disk drive head technology called GMR (Giant Magnetoresistive). GMR heads help drive makers increase areal density by packing data bits closer together on the drive platter.

Fujitsu increased the capacities of its server drives to 36.4GB, 18.2GB and 9.1GB. The drives, due in the first quarter of next year, will rotate at 7,200 and 10,000 rpm.

Fujitsu also increased its desktop drives to 17.3GB, 12.9GB, 10.8GB, 8.4GB, 6.4GB and 4.3GB. The drives will be available in volume in February.

Three new notebook drives from Fujitsu will provide capacities of 6.5GB, 4.3GB and 2.2GB.

The 4.3GB and 2.2GB drives will come in 9.5mm form factors and are available now.

Seagate has introduced seven new hard drives in its Cheetah and Barracuda families for desktops and servers.

New Cheetah drives include 9GB and 18GB Cheetah 18LP models, as well as the 36GB

Cheetah 36; prices range from \$695 to \$2,100. The drives will be available in February.

The new Barracuda drives will be available in the same capacities, priced between \$595 and \$1,815, this month. A 50GB Barracuda 50, priced at \$2,275, is expected to ship in March.

While they work to increase capacities, drive makers such as Quantum Corp. have also joined with eight PC vendors and Intel Corp. in support of Ultra ATA66, a new interface for desktop hard drives that increases bandwidth for transferring data from the drive.

The new interface doubles the speed of the previous ATA33 interface, which transferred 33MB of data per second, giving users notably faster access to their data, according to the vendors.

Drives that support the interface will appear late this year and early next year. One of the first at bat will be Irvine, Calif., Western Digital's WD Caviar 13GB drive for desktops, priced at \$339.

Getting small

Storage technology for devices such as handheld PCs and digital cameras is also coming into its own.

A number of new storage options, ranging from IBM's tiny hard drives to removable storage, such as Iomega Corp.'s Klik drive, will be on the market beginning at the end of this year.

And, flash memory, a solid-state storage technology used by many cameras and handheld devices, continues to increase in capacity and decrease in price.

Handheld PCs and digital cameras currently use memory cards, called Compact Flash, to store files. The cards, which come in two form factors, Type I and Type

II, can be used to store images and e-mail or to transfer data between devices.

Type I cards, the same size as a PC Card modem, currently store more data than Type II cards. Simple Technology Inc., for example, has developed a Type I flash memory card that can store as much as 224MB of data. It will be priced at about \$1 per megabyte.

Compact Flash Type II cards start at about \$40 for a 2MB card.



SyQuest's 1GB SparQ includes a model that links to a PC via USB.

Lexar Media Inc. recently introduced a 64MB card focused on digital cameras.

Several alternatives to flash memory are also in development. IBM recently unveiled two "micro-drives" weighing 0.7 ounce and measuring 1.7 inches by 1.4 inches. Two capacities, 170MB and 340MB, will ship in the middle of next year. The drives were designed to fit into a Compact Flash Type II slot in devices such as Windows CE-based handheld PCs. They will also work with notebook PCs when used with an adapter.

Iomega's Klik drive presents another alternative for handheld PC and digital camera users. The Roy, Utah, company's \$199 drive connects with a handheld PC using a PC Card slot and can be powered by its own battery. It uses removable 40MB disks that cost about \$10 each.

Also available to desktop and notebook users will be several new removable storage devices. SyQuest Technology Inc., of Fremont, Calif., this month will deliver new SparQ drives, priced at \$249, that use removable 1GB hard drive cartridges, including one that connects with a PC using Universal Serial Bus. ◀



Fujitsu recently introduced 19 hard drives.

Calling Information

Telecom consultant mixes caution, risk to meet customers' info needs

BY CAMERON STURDEVANT, PC WEEK LABS

ADVANCES IN storage technology are making it easier for Botting Systems Inc. to serve its customers—telecom companies that look to BSI to make sense of reams of telephone usage information for marketing, promotional and service needs.

Every week, the Vancouver, British Columbia, telecommunications consultancy receives and analyzes 40GB to 60GB of call information for telephone companies such as BC Telecom.

Higher-capacity disk drives and faster processors have allowed BSI to make call information available to its customers far more quickly and with drastically lower equipment investments.

BSI handles as many as 150 million data records stuffed with more than 300 information fields per week. This makes Greg Truesdell, vice president of systems development and support at BSI, an expert with a lot of experience when it comes to data storage.

Truesdell's MO is to blend risk taking with cautious planning. The result: an entirely new and improved storage system that cost the company \$120,000, compared with the \$3 million the outdated system cost.

There's no one product or technology that can be a substitute for a thorough understanding of business practices and a gutsy ability to recast the computing platform of your enterprise. Truesdell offered PC Week Labs several insights on storage technologies and strategies.

"When our company started, in 1996, we were getting 75GB of data for a five-week period and handling it with a 1993[-era] NCR Teradata machine with 12 parallel 486 processors. Using 38 2GB drives at the time, it seemed pretty remarkable," Truesdell said.

However, as every IT manager knows (and as IT managers associated with the fast-changing network arena are especially aware), technology that once seemed remarkable can all too suddenly seem slow.

BSI's online storage needs hovered at about 120 million records on any given day, but its customers' needs for quick access to the information was growing. The length of time needed to process call information for distribution to a data warehouse and eventually customer data marts was becoming untenable.

"Using the old system, it took as long as 72 hours to load and process 100GB of data, which was unacceptable," Truesdell said.

The company determined that it was trying to solve 1998 problems with 1993 equipment and operating systems. In a move that earned him a reputation for audacity, Truesdell implemented a project with a goal to completely replace the company's Tera-



BSI's Greg Truesdell thinks workstations are good workhorses for raw data.

data equipment with a storage processing platform based entirely on workstations.

Truesdell considers workstations, as opposed to servers, the best platform for the single-minded processing required to handle huge amounts of raw data. And with speed of the essence, Truesdell said it made the most sense to use drives directly attached to the machines they serve, trading off the administrative convenience of server- or network-attached drives.

The workstations Truesdell deployed are dual-processor, 400MHz Pentium-based systems that run Windows NT Server 4.0. Truesdell also used much larger drives, with capacities of 18GB.

As a result of Truesdell's work, BSI can process 120 million records in about 3.5 hours with storage reliability that is—so far, at least—100 percent. BSI pulled the plug on its multimillion-dollar system and hasn't looked back.

Appropriate caution

And while Truesdell and BSI as a whole demonstrated the kind of bravado that makes using new technology seem easy, they have been cautious in other areas. To wit: the

decision to stick with industry-proven 18GB drives when larger and faster devices are available.

BSI uses speed and capacity as its primary benchmarks, but the company tailors storage and processing to support the ultimate goal: reliable data.

"Reliability and processing speed are tremendously important to us, but we have pockets of requirements," Truesdell said. "In clearly defined segments—for example, at our central processing facility—stability is more important than in the volatile data marts."

The company also made some important decisions on how much to store and how long to store it.

BSI determined, almost at the beginning of operations, that six weeks is appropriate for storing records for active processing. BSI holds on to call data for up to six months—the equivalent of about 1.5 billion call records—in case additional information is needed for clients.

For now, 120GB of contiguous storage is adequate for BSI, but if the need arises, "we'll start the whole research process all over again," Truesdell said.

When questioned about future plans, Truesdell demonstrated an enthusiasm that is, well, unexpected in the usually staid field of data storage.

"Taking fiber connections to the desktop or [the] server bottom—wherever you want to put it—would be a good thing," he said. "Quantum processors [using light rather than silicon to fuel improvements in processing power] will blow our minds." ◀

Fibre Channel Wins Out

Beats out all varieties of SCSI, but hurdles remain

BY CARMEN NOBEL, PC WEEK

FIBRE CHANNEL IS EMERGING as the technology of choice for high-speed, long-distance SANs. It's faster than SCSI, but there are interoperability hurdles that must be overcome before widespread implementation takes place.

ANSI developed the Fibre Channel standard as a faster way to transfer data between servers and storage devices than its SCSI predecessor. As a result, Fibre Channel outperforms SCSI in several ways.

Running at 100M bps, Fibre Channel is five times faster than Fast-Wide Differential SCSI and outperforms UltraSCSI by 2.5 times. The bus arbitration is faster as well.

While SCSI is limited to a single shared bus cable, Fibre Channel can be used to attach devices through several methods, including single and dual loops, hubs, and switches. As such, Fibre Channel is well-suited for storage area networks (see story, Page 4).

How Fibre Channel works

Fibre Channel hubs make an arbitrated loop look like a series of point-to-point connections, according to Peter Gibbs, director of storage marketing at Data General Inc., of Westboro, Mass., which manufactures Fibre Channel-based storage systems.

Switches increase bandwidth by enabling

multiple devices to be connected via multiple loops, Gibbs said.

Fibre Channel also dramatically increases connectivity options. While SCSI devices are limited to connecting 16 nodes, a Fibre Channel arbitrated loop conceivably can connect up to 126 nodes—making it ideal for clustered server environments.

still has some growing up to do.

Because Fibre Channel is embedded in switches, hubs and routers, it is often difficult to connect these systems to servers and disk arrays made by different vendors. This, combined with the lack of software to manage Fibre Channel devices, has caused severe interop-

Fibre channel poised to take the lead

Worldwide RAID revenue forecast for all operating systems (in \$ millions)

RAID PRODUCT	1997	1998*	1999*	2000*	2001*
Host SCSI	360	10	49	43	35
Host Fibre Channel	400	1,090	4,770	12,378	21,668
Drive SCSI	230	46	0	0	-1
Drive Fibre Channel	146	387	2,474	6,007	9,761

*projected

Source: Dataquest (May 1998)

And companies with large campuses can use Fibre Channel for disaster recovery setups by keeping backup systems up to 10 km away from their main system because, with adapters, Fibre Channel cables can stretch that far.

"We have several customers who have data centers measured in acres rather than in square feet," said Doug Fierro, manager of network solutions at EMC Corp., a storage disk-array manufacturer in Hopkinton, Mass. "That's where Fibre Channel comes in."

This long-distance support, coupled with Fibre Channel's ability to support many types of devices, makes it a panacea of sorts for SANs.

Nevertheless, Fibre Channel

ability headaches for IT managers.

"There's a big problem with plug-and-play compatibility," said John Monroe, an analyst at Dataquest Inc., in San Jose, Calif. "But the fact that [Fibre Channel] is going to be a big part of the marketplace is certain."

Although all of the vendors adhere to some extent to the ANSI standard, the standard itself may not be strict enough. It gives companies enough leeway to try to outdo each other's products, which in turn makes it hard for the products to work with each other.

"The basic standard is complete," said Walt Hinton, vice president of strategy and marketing at Storage Technology Corp., in Louisville, Colo. "What they don't have is consistency of implementation of the standard. Most vendors want to create added value."

There is a light at the end of the tunnel, according to Data-

CONTINUED ON PAGE 19 ▶

Data Storage Harvest

◀ CONTINUED FROM PAGE 2

workgroups with high storage demands, as well as in clustered server environments. That's how Rockford Industries Inc., a health care financing firm in Santa Ana, Calif., is using its FibreStorage system from Houston-based Compaq. Rockford has installed a WolfPack cluster built around two ProLiant 6500 servers with four 200MHz Pentium Pro processors, with one server running the company's SQL Server files and the other holding its Microsoft Exchange software. The two servers share an 80GB FibreStorage system. The system went live in August, said Pete Appleby, director of information systems at the company.

"The advantage to this setup is that we've got a very fast storage system, and if one of our servers goes down, we're still up and running," Appleby said.

Appleby added that the WolfPack system and the FibreStorage system have made Rockford's network much faster. "Moving gigabytes of data around in mere seconds is pretty impressive," he said.

The setup has also reduced downtime to near zero, but there are still some weak points. "We still have a single point of failure in our connection to the storage system. We need redundancy for our Fibre Channel connection," Appleby said. Compaq officials said they will have a redundant connection available soon.

Blue Cross/Blue Shield of Georgia, meanwhile, plans to look into SANs next year. "We'd like to take a look at it. A SAN looks appealing, but we're not sure the technology is really there yet," Kannady said.

In a SAN, storage is removed from dependence on network servers and communication protocols and managed as an independent resource.

Essentially it is a pool of stor-

age devices, such as hard disk, tape and optical drives located on a dedicated subnetwork shared by all the systems on the primary network, explained Anders Lofgren, an analyst at Giga Information Group, in Cambridge, Mass. While SANs may sound like nirvana, they are not a fact of IT life

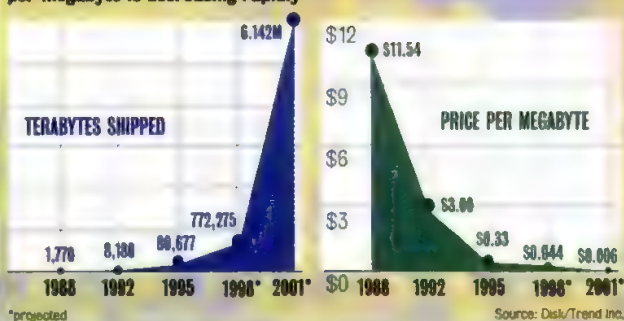
SAN support to NT yet. NT isn't slated to support SANs until Version 6.0, but that could change.

Progress on the standards front

However, there is progress. Recently, software vendor Veritas, of Mountain View, Calif., demon-

Plummeting storage prices

While the total shipped disk capacity continues to increase, overall price per megabyte is decreasing rapidly



yet. "I expect to see high-end Unix shops go first over the next two to four years," Lofgren said. Because of the expense of some of the devices required, such as routers and hubs, most price-sensitive Windows NT shops may hold off longer to move to SANs, he added.

And, while some SAN puzzle pieces are there, such as Fibre Channel interconnects and higher-throughput switches, hubs and routers, others are missing, such as interoperability, Lofgren said. There are no standards yet to ensure that servers and storage devices from different vendors will communicate (see story, Page 17). The Storage Networking Industry Association says those will appear next year. Storage vendors say they will be available in products shortly after that. And Microsoft Corp. has not brought

strated software for managing server clusters connected to SANs. Cluster Server manages LAN- and SAN-based cluster configurations with as many as 32 nodes. A Java-based management console allows central-

'Storage is like a gas. It will fill whatever vessel you put to contain it in.'

—Dave Kannady,
Blue Cross/Blue Shield

ized monitoring of multiple clusters. An NT version is expected in the first half of next year, with a version for HP-UX in the second half.

While SANs will give users greater speed by giving stored data dedicated 100M-bps bandwidth for data transfers, they should also give IT managers something else: flexibility.

"We see them as a way to change the way we allocate disk to servers," said Blue Cross/Blue Shield's Kannady. "That way we can better match a system's needs to its most suitable type of storage. If we need a high-level type

of storage, we can dedicate a mirrored disk array. If we don't need fast access, we can just use some regular drives."

Some users have found devices that can give them fast access without setting up a SAN. At Irell & Manella, a law firm in Beverly Hills, Calif., IT Manager Bob Pryor is using a storage device from Solid Data Systems Inc., of Santa Clara, Calif., that gives the company fast access to its most used files. However, the 80/20 rule applies. "We found we really only use about 10 to 20 percent of our files more than 80 percent of the time. So we've moved those files to the Solid Data product, which gives us access to files like they were local," Pryor said.

Solid Data's Excellerator keeps a company's most-used files stored electronically on RAM.

While the cost of such devices is not cheap, Pryor said the cost has been worth it in terms of productivity. "We can open up those files very fast, and it keeps our overall network traffic down as well, so there are a lot of advantages to this setup," he added.

SANs will give IT managers some independence from storage vendors, said Giga's Lofgren. "Today you can use, say, a Compaq server array with a Hewlett-Packard Co. server, but it's probably not the best fit. With a SAN it won't matter," he said.

For example, while Rockford standardized on the Compaq storage systems along with its Compaq server, other shops don't have that luxury. Independent vendors offer an advantage for multivendor shops, according to Kannady. Blue Cross/Blue Shield decided to use an independent storage vendor, Artecon, as opposed to one of its server vendors because Blue Cross/Blue Shield has inherited a variety of servers over the years. "By using an independent vendor we knew they'd support the different servers we have from Compaq, NCR [Corp.] and HP," Kannady said.

But managing those indepen-

dent storage products may be a challenge for some time to come. HP's Fibre Channel Manager currently integrates with the company's OpenView management software. But eventually it will also work with Computer Associates International Inc.'s Unicenter and IBM's Tivoli Enterprise systems management software offerings. It will also eventually manage other SAN components besides HP's own Fibre Channel Arbitrated Loop device.

"Everybody's moving in the right direction," said Giga's Lofgren. "It's just going to take some time to get everyone there at the same time." For now, Lofgren advises IT managers begin moving to Fibre Channel products. "That way you'll be ready when the SAN products are available," he said.

And while some users are already moving in that direction, they also know that storage needs will continue to increase.

"Storage is like a gas. It will fill whatever vessel you put to contain it in," Kannady said. ◀

Fibre Channel Works Well in SANs

◀ CONTINUED FROM PAGE 17

quest's Monroe: "Drive interoperability should be solved within the next generation of enterprise drives, and we should overcome most of the other [hardware] barriers within a year and a half, if that long. There's a lot of activity on solving the interoperability issues."

Storage management glitches

Systems administrators report that the ability to manage their SANs is just as vital as having a SAN in the first place.

"A lot of the management [issues] are not mature in the open systems storage arena," said Loren Olsen, senior manager of groupware and e-mail systems at Sprint Corp., in Kansas City, Mo. "[Storage management] needs to be built into the operating system rather than just through third-party [products]."

Storage companies admit that a lack of proficient manage-

ment software is a problem.

"Fibre Channel needs to go a long way in terms of management software," said EMC's Fierro. "At this point, customers generally are dependent upon management software from the various server vendors or from third parties who license their software to server vendors. This can get confusing if a company is using several brands of servers in a network."

EMC and other storage companies are working on this problem by cooperating with companies such as Veritas Software Corp., of Mountain View, Calif., to devise a paramount software solution, according to Fierro.

Meanwhile, companies such as Storage Technology are embedding intelligent software into interconnect devices—the hubs and switches—rather than into the server or the disk arrays, according to company officials.

Since so many network functions are the responsibility of the interconnect, it makes sense for these devices to be "smarter," officials said.

Not the right fit for all

Still, even when Fibre Channel gets its kinks out, it may not be for everyone.

"We need Fibre Channel because we have lots of large Web servers that are driving lots of I/O," Sprint's Olsen said. "If you consider that you can scale large storage farms with it, Fibre Channel becomes economical—but that's only on the high end."

Fibre Channel doesn't make a lot of sense for Windows NT environments right now either, he added, because NT Cluster Server currently can only group two servers together. But as NT clustering becomes more widespread, so will Fibre Channel installations, he said. ◀

NAS Devices

◀ CONTINUED FROM PAGE 3

migrating file systems.

NAS devices are designed to work with existing network infrastructures. After plugging a NAS device into a network and assigning it an IP address,

all an administrator needs to do is set up access control lists and user permissions before making a NAS device available to users.

Although most NAS products have built-in security features to control user access, most IT shops would be wise to continue to rely on their existing network operating systems. ◀

SANs' Future

◀ CONTINUED FROM PAGE 4

To simplify management, SAN vendors need to develop or migrate protocols such as SNMP to monitor and control devices on SAN networks.

Although Compaq's Fibre Channel SAN technology allowed us to share and manage all our storage devices from a single GUI console, each network operating system we introduced to Compaq's SAN offering demanded its own logical partition.

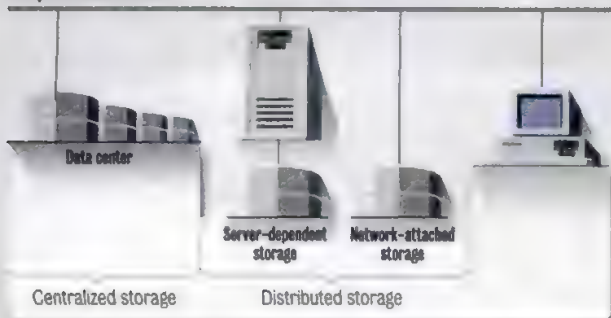
To make matters worse, since dynamic partition reconfiguration is not available, we had to do a lot of tedious work to adjust storage partitions to meet our storage needs. In tests, the only way we could readjust partition capacity among different operating systems was to run a backup of our data volumes, re-

format and repartition our external storage devices, and finally restore our data from tape back to the freshly repartitioned storage devices. For mission-critical environments, this process is not practical and cannot be accomplished without a substantial amount of downtime.

The clustering technology that is available for Windows NT (Microsoft Corp.'s Cluster Server) and Novell Inc. NetWare (Novell High Availability Server for NetWare) is not up to snuff. Both solutions provide only failover, with no performance-enhancing capabilities, and are limited to just two nodes. ◀

Network-attached storage at work

Enterprise backbone network



Source: Aberdeen Group, January 1998

User access

Now have PC Week's Best of Comdex products fared since winning the awards? Which products took home the prize from Las Vegas? Log on to www.zdnet.com.

see storage differently

Your Last Modern?

As faster technologies nip at market share and more PC makers integrate V.90 modems, this may be the last modem you buy. BY LES FREED

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SOME DAY, WE'LL ALL have multimegabit cable-, DSL-, or satellite-based connections to the Internet. But for now, most of us still need to make do with analog connections—and that means we still need modems. Fortunately, the new crop of V.90-compatible 56-Kbps modems will help ease the wait.

For this year's roundup, we've departed from tradition. Rather than inviting vendors to submit one or two products for review—usually an internal and an external unit—we evaluated each vendor's full product line, inviting them to submit an unlimited number of models, with the proviso that we would test one unit of its choice. We made an exception with 3Com, agreeing to test two units.

The V.90 protocol, finalized this past September, puts an end to the K56flex/x2 compatibility issues that have kept consumers confused for over a year. You probably know that the V.90 standard is the result of a compromise among the x2 and K56flex camps in the modem industry. Most vendors jumped the gun and began offering V.90-compatible modems last spring. Today, any 56K modem you buy

Our Contributors: LES FREED and STEVE RIGNEY are contributing editors of *PC Magazine*. DAVID BARDES is a technical specialist at ZD Labs. KEVIN YOUNG was the project leader, and TONI F. KISTNER was the associate editor in charge of this story.

www.pcmag.com

How well do soft modems run on slower systems? We tested them—and you might be surprised at what we found. Join us online for the results.

contains either native V.90 code or is flash-upgradable to the standard.

As you can see from the results, a higher price tag won't necessarily buy better performance (turn to our performance tests for details). The 3Com U.S. Robotics Courier V.Everything Modem (\$240 list), our Editors' Choice, led the pack, but the inexpensive Boca WinStorm 56K Modem (\$70 street), a soft (or controllerless) modem, was close behind.

THE DUST SETTLES—SORT OF

There are three 56K modem designs, based on chip sets from each of the three major modem chip makers: Lucent, Rockwell, and 3Com. Though they're all compatible with V.90, the modems in our roundup can also operate in another of two 56K modes. The Lucent- and Rockwell-based modems can also operate in K56flex, and the 3Com-based products can operate in x2.

This dual-mode capability may be crucial for some users, because not all of the world's *back-end* equipment—the host routers that answer your call when you dial into your local ISP or corporate RAS—has been updated to V.90. Most of the major back-end equipment vendors have released preliminary V.90-compatible updates for their remote-access servers. Some ISPs and corporate RAS administrators have been slow to deploy V.90, however, opting to wait until the final code's release.

BUT WHAT TO BUY?

Before you buy, ask yourself some questions. First, do you want an internal or external model? Internal modems take up an expansion slot in your system—but no space on your desk. External units require an AC power connection and a serial, parallel, or USB connection to your PC. An external modem offers status LEDs, a power on/off switch, and a speaker.

Next, do you want a speakerphone modem? Many products include an extra set of jacks so you can connect speakers and a microphone. You can then place

and receive voice calls, and most include voice mail software that turns your PC and modem into a phone/fax/voice mail system. But too many features make a modem difficult to use. Our advice? Put your extra dollars toward an answering machine or voice mail service instead.

If you're settled on an internal modem, you then need to choose which type. A conventional, *controller-based* modem has an on-board CPU to handle the routine things that maintain a connection. New *controllerless* modems—often called *soft modems* or *WinModems*—off-load much of this work onto the PC's CPU (see the sidebar "A Different Kind of Modem" for more details).

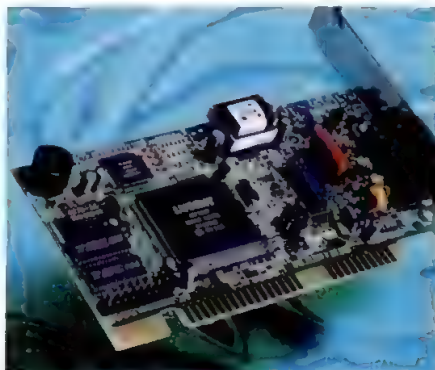
Last, should your internal modem be based on PCI or ISA? Though PCI bus devices operate at up to 20 times the speed of ISA devices, modems aren't fast enough for bus speed to matter much. But PCI provides more sophisticated plug-and-play than ISA, and several PCI devices can share a single interrupt request (IRQ) line.

Read on to see which package best suits your needs.

ActionTec DeskLink Pro PCI Windows Modem

\$69 list, \$60 street. Sunnyvale, CA; 800-797-7001, 408-752-7700; www.actiontec.com; 900 at www.pcmag.com/infolink.

● Distinguished here as the least expensive modem we tested as well as one of only two that use a PCI interface, the ActionTec DeskLink Pro PCI Windows Modem provides good performance and a rich software bundle sure to attract anyone seeking a bargain.



Though it was the least expensive model we tested, the DeskLink Pro from ActionTec delivered near-top speeds.

Installation could have been easier, though. Microsoft Windows 98 provides a driver for nearly every modem model we tested except the DeskLink Pro, so it didn't recognize the device automatically. Fortunately, the package included a disk that helped us install and configure the DeskLink Pro to work on both our Windows 98 and Windows NT 4.0 test systems, but that added an extra step.

The PCI interface didn't improve performance significantly, as we expected. The modem landed in the midrange on most of our tests, though it excelled on our Moderately Compressible File Transfer test, placing first when connecting to the Ascend and second connecting to the 3Com back end.

For the price, the DeskLink Pro's software bundle is surprisingly useful: Along with a 30-day trial version of VocalTec's Internet Phone is a full version of Cheyenne's BitWare telephony software. With BitWare, we could use the built-in caller ID to control voice mail messages and broadcast fax messages. For example, we could import a text file of users and their fax numbers and then instruct the DeskLink Pro to fax the predefined users a message. All in all, the DeskLink Pro is a good value.—Steve Rigney

Apache NetExpress A56SP-RA

\$98 list, \$90 street. Irvine, CA; 800-330-1328, 949-251-1818; www.apache-micro.com; 901 at www.pcmag.com/infolink.

● Like ActionTec, Apache Micro Peripherals isn't a household name. But the company offers a complete line of well-priced modems. It sent us two, an internal and external model—each providing fax and speakerphone capabilities. Unfortunately, the performance of the internal Apache NetExpress A56SP-RA we tested was the slowest we saw, tarnishing the bright spots considerably.

The A56SP-RA is a small ISA card that can be configured for plug-and-play operation or for a special port via jumpers, like similar models from Boca and 3Com. This is handy for use with older machines. A quick-start guide explains the jumper settings in detail, but we often found the manual confusing: For example, it claims the default port setting is COM4, but our test unit was set to COM2.

Apache's external fax modem, unlike



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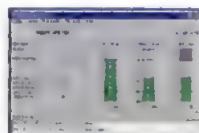
Measure-UPS (Temp. and Humidity) — Provides monitoring of temperature, humidity and other environmental conditions through the interface for PowerChute plus, PowerNet SNMP or Call-UPS II.



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editors' choice

• 3Com U.S. Robotics Courier V.Everything Modem



With the V.90 standard a reality and most back-end equipment in place, the playing field has leveled out since last year's 56K modem roundup. Though vendors continue to add plenty of bells and whistles to differentiate their products, you should base your buying

decision on performance and reliability. Once again, 3Com delivers the hands-down winner: the 3Com U.S. Robotics Courier V.Everything Modem (\$240 list).

This internal modem excelled on our performance tests, negotiating fast connections over the nastiest phone line conditions via its high throughput speeds and ability to probe the line to select better signal sets. And though it's priced considerably higher than much of the competition, the V.Everything includes useful features you won't see elsewhere, including remote management and security features geared for road warriors and businesspeople. Documentation, both print and on-screen, was helpful, and installation was a breeze.

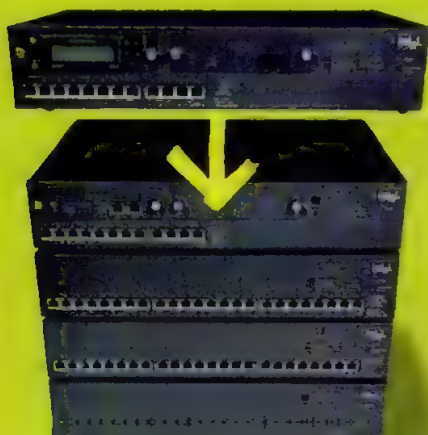
As a bonus, the software on the included Collections CD-ROM is one of the better bundles we saw. Look to packages from ActionTec, Boca, and Compaq, as well as for exceptional bundled software.

Other modems in this roundup deserve mention. Although none of the modems we tested had difficulty performing on clean phone lines, another modem held up well under adverse conditions: the Compaq Microcom 415 56K External Modem with Speakerphone. We were also impressed with the performance of the models from ActionTec and Hayes, which negotiated the Moderately Compressible File Transfer test with ease. And for users on the lookout for a bargain, the modems from Boca and Diamond combine respectable throughput speeds with lower price tags.

SCALE -adjust-expand-adapt-grow-

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most comparable models, includes a serial cable to connect the unit to your PC. Unfortunately, the cable provided has 25-pin connectors on both ends, even though all PCs built since 1984 use a 9-pin connector at the PC end of the cable.

Fax and speakerphone capabilities are provided via Apache's Mega Connect and Mega Voice fax and voice software. We found that these newly developed programs worked well, but the interfaces and graphics were still a bit rough around the edges. Documentation was satisfactory, including a quick-start guide and CD-ROM. Though the Apache line shows some promise, the modem field is chock full of superior products.—*Les Freed*

Boca TidalWave 56K External Speakerphone Modem

\$130 street. Boca Raton, FL; 561-997-6227; www.bocaresearch.com; 902 at www.pcmag.com/infolink.

● Boca Research submitted four modems from its TidalWave series for review—two internal and two external—as well as

the WinStorm PCI speakerphone modem (\$70 street), a soft modem. We tested the performance of one TidalWave modem and the WinStorm, each of which delivered fine performance. Boca modems are full-featured products that include useful software bundles.

The Boca TidalWave 56K External Speakerphone Modem includes an external microphone and a jumper cable to connect the device to the PC's sound input. It provided clear voice connections, but because the speaker and microphone connectors were situated on the front, we had to deal with a mess of cables—not a well-thought-out configuration.

The TidalWave modems include a 30-day trial version of MidCore Software's MidPoint Gateway proxy server and a full version of MidCore's Modem Teamer. Similar to the Diamond line's built-in Shotgun technology, Modem Teamer lets you combine the bandwidth from two 56K modems into one 112K connection—if you have two phone lines and ISP accounts.

The TidalWave 56K placed third on



Boca's modems come with Midcore Mid-Point Gateway proxy server software.

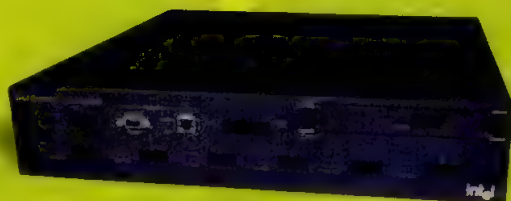
our Noncompressible File Transfer test when connected to the Ascend server. But the modem back-end equipment experienced problems connecting to the 3Com (see the test analysis for details).

The WinStorm is one of the few PCI card modems we've seen. Despite its bargain price, Boca packages the unit with everything you need for speakerphone use, including a short cable to connect the modem to your PC's sound card input. The package includes Smith Micro's Quick-

connect-deploy-evolve-ABILITY.

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PERFORMANCE TESTS

V.90 Modems



Over the past several years, 3Com modems have performed at or near the top of the charts in our modem roundups. This year is no exception: The two 3Com U.S. Robotics modems we tested were the best performers on our Impairment tests.

Although all the modems performed well when phone line conditions were benign or had only a moderate amount of noise and distortion, we saw from our Impairment tests that differences among modems become apparent when line conditions grow more severe. Products with high average throughput, such as the Microcom 415 and the 3Com U.S. Robotics Courier V. Everything Modem, can handle most conditions. Luckily, most V.90-capable U.S. phone lines do not carry much noise and distortion.

Several modems, including the Boca TidalWave 56K External Speakerphone Modem and the Hayes Accura 56K/V.90 Internal Data/FAX Modem, failed to negotiate our toughest, dirtiest phone-line conditions and dropped the calls altogether. Others, such as the Diamond SupraExpress 56i and the Zoom 56Kx Dualmode FaxModem, reported a V.90 connection but had difficulty transferring the files, retraining to a lower connection rate and resending data packets to complete the transfer. Still others, such as the ActionTec DeskLink Pro PCI Windows Modem, dropped back to a V.34 connection and transferred the data successfully. A few—such as the Compaq and 3Com modems—selected a better signal set via line probing and successfully transferred the data at a faster rate than the other modems we tested.

The need and the ability to probe phone lines is unique to *PCM modems*—those that comply with V.90, x2, or K56flex. At the beginning of a phone call, a *line-probing* modem looks for the

IMPAIRMENT

denotes Editors' Choice. Kilobits per second Bold type denotes first place. Ascend 3Com

ActionTec DeskLink Pro PCI Modem	71.4 62.7	
Apache NetExpress A56SP-RA	69.3 53.2	
Boca TidalWave 56K External Modem	64.8 49.6	
Boca WinStorm 56K PCI Modem*	71.0 76.6	
Compaq Microcom 415 56K Modem	76.1 81.2	
Diamond SupraExpress 56i	65.3 51.1	
Hayes Accura 56K/V.90 Internal Modem	55.7 56.3	
MultiTech MultiModem ZDX	71.2 68.2	
3Com U.S. Robotics Courier V. Everything	71.0 83.5	
3Com WinModem*	61.9 49.4	
3Com U.S. Robotics 56K Faxmodem	72.0 84.0	
Zoom 56Kx Dualmode FaxModem	71.5 58.0	

* Soft modem: see the sidebar "A Different Kind of Modem"

opportunity to use the V.90 protocol, then determines how best to transmit the data by sending test tones. The line probing is heard as the growl or bong tone when a V.90 modem is making a connection. The more accurately the modem determines what kind of noise is in the signal path, the more stable the connection will be and the faster data will be transferred.

We tested the modems using two of the most common remote-access servers (RASs) used by ISPs and businesses, an Ascend Max 4048 with Rockwell digital modems and a 3Com Total Control with 3Com U.S. Robotics chip sets. Both were upgraded to the latest V.90 code. Generally, the modems performed better with the Ascend RAS, which may be explained by the RAS types used by modem vendors for their own internal testing. The 3Com modems performed better with the 3Com RAS—not an unexpected result. To our surprise, several of the modems with Rockwell chip sets came to us with an older version of firmware. Although the older firmware worked well otherwise, it had quirks that did not let us connect with 3Com's RAS via Dial-Up Networking. In speaking

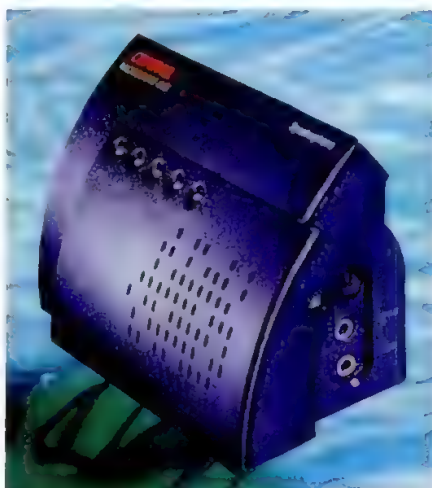
Link III voice/fax/data communications package, as well as Microsoft Internet Explorer 4.0 and Netscape Communicator 4.0. The WinStorm turned in impressive numbers on our performance tests, beating out products that cost twice as much.

No matter which model you choose, the Boca modems are first-class.—LF

Compaq Microcom 415 56K External Modem with Speakerphone

\$150 street. Houston; 800-888-0220; www.compaq.com/products/networking/modems.

● When you think of modems, Compaq Computer Corp. doesn't come to mind. But the company's purchase of Microcom in 1997 turned it into one of the most



The Compaq Microcom 415 provides strong, reliable performance.

respected PC modem manufacturers overnight. The vendor provided three units—one low-priced internal, one parallel-port external, and a well-designed external unit with a speakerphone we'd actually use. The third unit performed well, placing just behind the 3Com units on our Impairment test.

The Compaq Microcom 415 56K External Modem with Speakerphone is a small, stylish box that connects via a bundled 9-pin serial cable. Side-panel connectors let you attach the external speaker or microphone, and there's a magnet to attach the speakerphone atop your monitor. The speakerphone provided loud, clear audio that projected across the room.

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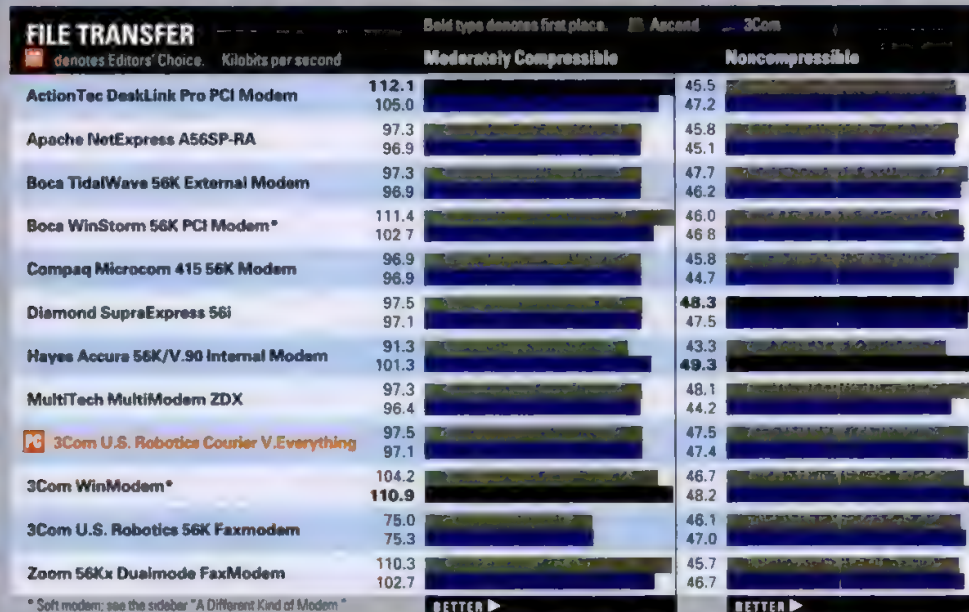

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PERFORMANCE TESTS



The Moderately Compressible

File Transfer test and the Noncompressible File Transfer test give you a good idea of how well modems download compressible data such as text, e-mail, and HTML, and non-compressible data such as graphics and ZIP files.

The tests revealed the limitation of the serial port when transferring uncompressed files: The internal ISA and PCI modems outperformed the standard external modems in the file transfers. The ActionTec and Hayes modems proved especially quick at transferring the highly compressible files (results not shown).

with the vendors, we discovered that the same problem could occur with some Livingston and Lucent RASs as well. Chances are very good, though, that you will not run into this problem, as most session connections do not rely on Dial-Up Networking for reporting connection responses. A quick remedy is available: We simply updated the modems with the latest firmware and drivers. —Analysis written by David Bardes

How We Tested

For our Impairment tests, we used 18 different combinations of line noise and distortion, ranging from mild to severe, and averaged the results. Each modem ran the gauntlet twice, once for each type of RAS on which we tested. Once a connection was established, we transferred a text file from the FTP server and recorded the transfer rate.

For the Moderately Compressible File Transfer test and the Noncompressible File Transfer test, we transferred five different types of files over the modems when calling into each RAS: an uncompressed

graphics file, ASCII text, an executable file, and a compressed file; the fifth file was a mix of uncompressed text and compressed data. We print the results from two of these tests. Unlike the Impairment tests, the transfer tests were performed in an almost-clean phone-line environment.

To simulate the entire range of phone line conditions most modems will encounter when connecting to a phone-company central site, we used a Telecom Analysis System (TAS) 240 local-loop emulator and a TAS Series II central-site simulator. We then connected the TAS Series II central-site simulator to the RASs through a channelized T1 line.

We used Dial-Up Networking to connect to the Ascend Max 4048 and the 3Com Total Control Remote Access Concentrator. These were connected to an Ethernet network running a dedicated FTP server. A Dell Pentium/133 PC was our client for the hardware modems, and a Dell Pentium II/400 PC was our client for the soft modems (for details, see the sidebar "A Different Kind of Modem").

The Compaq Microcom 510 56K External Fax Modem is one of the few parallel port modems we've seen. Compaq claims that the design provides up to 475 Kbps of throughput, eliminating the 115,200-bps bottleneck created by serial ports. The rear panel of the 510 has serial and parallel connectors, and a short, 1-foot parallel cable is provided; serial-port users will need to purchase a cable. The 510's on-screen status-light utility and software maps the parallel port to an unused serial port address, letting you use the modem with any communications software.

Compaq ships the Microcom 415 and the 510 with a copious software bundle, including both Microsoft and Netscape

browsers, as well as Adobe Acrobat, NetMeeting, PointCast, and Teamware's Embla e-mail client. We especially liked the Trio data/fax/voice mail software, which provides a full communications center when used with the 415. The Trio can use the modem's caller ID and distinctive ring features to identify and route incoming messages and faxes.

The Compaq Netelligent 56K Internal Fax Modem is a simple-to-install ISA card that includes Delrina's WinFax Lite fax software and WinComm data communications program. Compaq plans to provide the same software bundle as with the Microcom 415 and the 510. Each Compaq modem is a worthy competitor in a tough market.—LF

Diamond SupraExpress 56i

\$99.95 list. San Jose, CA; 800-468-5848, 408-325-7000; www.diamondmm.com; 903 at www.pcmag.com/infolink.

● If you're shopping for a bargain-priced modem but want voice mail, fax, and speakerphone features, make a beeline for Diamond Multimedia's Supra line. The company sent four models ranging in price from \$99.95 (list) for an internal Supra-Express to \$149.95 (list) for the internal dual-modem SupraSonic II. Each includes Diamond's Shotgun technology for combining two modems' throughput, as well as useful communications software. The Supra modems most closely match the Boca line but provide slightly better performance at a cheaper price.

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Diamond's Shotgun software lets you bind two modems for extra speed.

We found the modems easy to install, and the documentation, though brief, was simple to follow. We especially liked the Communication Center, FaxCenter, and FaxTalk software, which made sending faxes and setting up voice mail simple work. Moreover, a bundled CD offers 50 consumer-oriented software titles.

Our performance tests showed that the Diamond SupraExpress 56i offers plenty of bang for the buck; it did especially well on our Noncompressible File Transfer test, placing first and third.

Diamond's Shotgun software uses Microsoft's Multilink PPP protocol but adds two important features: bandwidth on demand, which means that the software will add the second modem only when traffic requires it, and voice priority, which works with Call Waiting to disconnect the second modem if someone tries to dial into or out on the line. One modem must be a Supra 56K; the second doesn't have to be 56K or even a Supra model, though the voice-priority feature will work only with the dual-modem Supra-Sonic. You'll need to use an ISP that supports Multilink PPP and also provides it as a service. Fortunately, many do—one of the largest ISPs, Netcom, for one.

The Diamond modems offer excellent features and advanced software at low prices.—SR

Hayes Accura 56K/V.90 Internal Data/FAX Modem

\$119 list, \$100 street. Atlanta; 770-840-9200; www.hayes.com; 904 at www.pcmag.com/infoclink.

● In October, Hayes filed for Chapter 11 bankruptcy, announcing a shift in focus from modems to the broadband, RAS, and Voice-over-IP markets. This came as

a surprise to us, considering the company had recently sent us the Hayes Accura 56K/V.90 Internal Data/FAX Modem (\$119 list) from the Hayes Accura line for testing, as well as the Dennis Hayes 20th Anniversary Modem (\$149). We were impressed with the Anniversary unit. It offers a full range of features not found in the Accura model we tested, including voice mail and a full-duplex speakerphone. And unfortunately, the Accura 56K/V.90's performance on our tests was slower than average.

We found the Accura 56K/V.90 fairly easy to install, which is important because of its very brief installation manual and a similarly basic online manual. Designed for the home user, the internal modem retails for around \$100 (comparable to better performers such as the Boca and Diamond products) and doesn't include voice mail or speakerphone capabilities.

Uniquely, the Anniversary is designed to be placed atop the monitor. You get a large speaker to hear callers and a small microphone. We also liked the bundled PhoneTools software, which let us answer calls, view voice messages, and create a phone book of frequently used numbers.

Both the Accura and Anniversary modem packages include NetSonic acceleration software. This Windows-based package lets you increase the speed of your Internet connection by frequently caching data on the Web sites you visit.

Hayes hasn't announced that it will stop supporting the modem lines. Even so, comparison of the Accura 56K/V.90 with others in this roundup makes it hard to recommend the Hayes modem.—SR

MultiTech MultiModem ZDX

\$239 list, \$160 street. Mounds View, MN; 800-328-9717, 612-785-3500; www.multitech.com; 905 at www.pcmag.com/infoclink.

● With prices ranging from \$239 to \$299 list and \$160 to \$200 street, the MultiModem line is one of the more expensive in this roundup. But there's something for everyone in the dozens of modems here. We liked that all of the seven modems we tested (two internal and five external) offer the same documentation, a five-year warranty, and the ability to store two numbers, as well as Class 2 fax capability. Also, the MultiTech MultiModem ZDX's performance was respectable—especially

SUMMARY OF FEATURES

V.90 Modems

	ActionTec DeskLink Pro PCI Windows Modem
■ YES ■ NO	
List/street price	\$69 / \$60
Internal or external model	Internal
Chip set manufacturer	Lucent
OS support	Windows 95, 98, NT
Dimensions of external modem (HWD, in inches)	N/A**
LEDs (external model)	N/A**
Slot size (internal model)	PCI
Protocols supported	V.90, K56flex
Features	
Data	■
Fax	■
Voice	■
Speakerphone	■
Caller ID	■
Distinctive ring	■
Error control	■
Carrier-loss redial	■
Automatic rate adaption	■
Automatic fax or data connection	■
Full duplex	■
Backward-compatible	■
Upgrade Method to ITU Standard	
Exchange	■
Software upgrade	■
Flash ROM upgrade	■
Service and Support	
Technical-support hours (eastern time)	10:30-7:30 M-F
Technical-support number	408-752-7714
Warranty (parts and labor)	5 years
N/A**—Not applicable. The vendor does not cite this price.	

on our Noncompressible File test; it came in second on the Ascend back end. Nevertheless, these pluses don't balance out the fact that comparable modems from Boca, Compaq, and Diamond will cost you about half the price.

Although we appreciated the range of choices, we found the sheer number of MultiTech modems confusing. MultiTech offers four models for retail sale; the others are available for corporate environments through value-added resellers. If you want just a run-of-the-mill external model, go with the MultiModem ZDX; it offers the same capabilities, plus voice mail. Some models support 11-bit hardware; others are based on the Lucent chip set; still others are based on the Rockwell solution.

The modems were a snap to install, and

N/A**—Not applicable. This is an internal model. N/A—Not applicable. This is an external model.



PC
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EDITORS'
CHOICE

The V.Everything (\$290 list) is 3Com's flagship internal modem. It includes a small getting-started guide and a quick-reference card with essential AT commands and register settings. Aimed squarely at the corporate market, the V.Everything provides remote management, automatic redial, and security features not found in the lower priced modems. Its on-board digital signal processor is more powerful

DECEMBER 15, 1998 PC MAGAZINE 213



a different kind of modem

CONTROLLERLESS MODEMS—often referred to as soft modems—rely on your system's CPU for much of their processing needs and shift all the modem protocols, error correction, and data compression into software. The architecture lets modem makers develop a much cheaper model that doesn't demand the RAM or processing power of traditional hardware units.

Though lower prices are attractive, controllerless modems have limitations and advantages that need to be weighed carefully. Since there are fewer components on the modem board, they consume less power. Only a few milliwatts is enough to make a difference, though, especially on a laptop. And since software performs the processing, there's no hardware limitation to added features, making enhancements and upgrades easy to execute.

On the downside, most vendors recom-

mend a Pentium processor and at least 16MB of RAM. And soft modems are designed with specific Windows operating systems in mind. There's nothing for RedHat or Solaris yet. Just as important is how much of a drain a controllerless modem puts on your system. To find out, we tested the Boca WinStorm 56K Modem and the 3Com U.S. Robotics 56K Winmodem. Though these modems are designed specifically for low-cost computer bundles, they're sold on store shelves beside traditional hardware modems.

We tested each modem on two different Dell platforms, a 400-MHz and a 133-MHz. Both products performed comparably with the hardware modems we tested, with the WinStorm edging out the Winmodem slightly on both file transfer speed and CPU utilization. To measure CPU utilization, we used a software utility that let us measure the

effect of the file transfers. On the 400-MHz system, the 3Com unit used 8 percent of the processing power, and the Boca used just 6 percent. (For comparison, running a QuickTime video used 22 percent.) To our surprise, the modems turned in nearly the same file transfer rates on the 133-MHz system, though they ate up more CPU power. The WinStorm used 17 percent of system resources, while the Winmodem used 25. Clearly, the modems benefit from using a slot interface (ISA for the Winmodem and PCI for the WinStorm), which gained faster throughput of uncompressed files. Note, though, that we conducted our tests without any other programs open or running.

To find out how the soft modems performed on less powerful platforms—a Pentium 90 system and a 486—turn to the online version of this story at www.pcmag.com.—David Bardes

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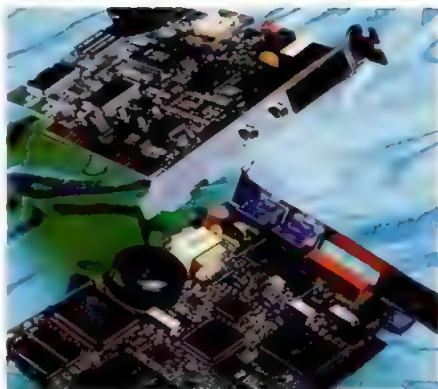
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The V. Everything modem from 3Com beat out the competition on our tests.

than the consumer product's, giving the unit better performance over marginal phone conditions.

As with the 3Com 56K Faxmodem, you can configure the V. Everything using plug-and-play or via jumpers for a specific COM port. Like all Courier modems, the V. Everything has a row of DIP switches, accessible from the PC's rear panel, which let you set carrier detection, flow control, and auto-answer options in hardware—all helpful features for remote users.

Both lines are covered by 3Com's limited lifetime warranty and include very useful online documentation. You also get an extensive software bundle (second only to Boca's offering), which includes 3Com's Connections CD-ROM—a collection of excellent fax, Internet, diagnostic, and demo programs. Altogether, 3Com's modems are in a class by themselves.—LF

Zoom 56Kx Dualmode FaxModem

\$149 list, \$100 street. Boston; 800-631-3116, 617-423-1072; www.zoomtel.com; 907 at www.pcmag.com/infolink.

● In this fiercely competitive market, Zoom Telephonics' modem line distinguishes itself with excellent documentation, useful features, and plenty of software—as well as support for the V.80 protocol, which lets you conduct videoconferencing over dial-up connections. The company sent us internal and external versions of the Zoom 56Kx FaxModem. We tested the performance of the external 56Kx Dualmode FaxModem (\$149 list), which did well when connect-

ed to the Ascend access server but turned in only average scores when connected to the 3Com back end.

In a field where smooth plug-and-play installations are taken for granted, we experienced trouble installing the internal unit. Our Windows 98 PC didn't recognize the device, but we were able to complete the installation by using the jumpers on the adapter board.

Both modems support voice mail capability, but you'll need to supply an extra sound adapter to use it. As with many of the better products here, the Zoom modems were able to auto-select between V.90 and K56flex access servers and pick the right protocol, ensuring reliable performance.

A CD-ROM chock-full of software programs, which includes Communicate! Light and Paint Shop Pro, is bundled with the units. We especially liked Communicate!, which let us set up voice mail and connect to other ISPs.

The Zoom modems are a fine choice, especially if support for videoconferencing is of interest to you.—SR 

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A woman in a business suit is running on a treadmill in what appears to be an office or server room. In the background, a man is sitting at a desk, looking at a computer monitor. The scene is dimly lit, with light coming from the computer screens and the treadmill's console.

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— BYTE Magazine, April 1998

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— Macworld Magazine,
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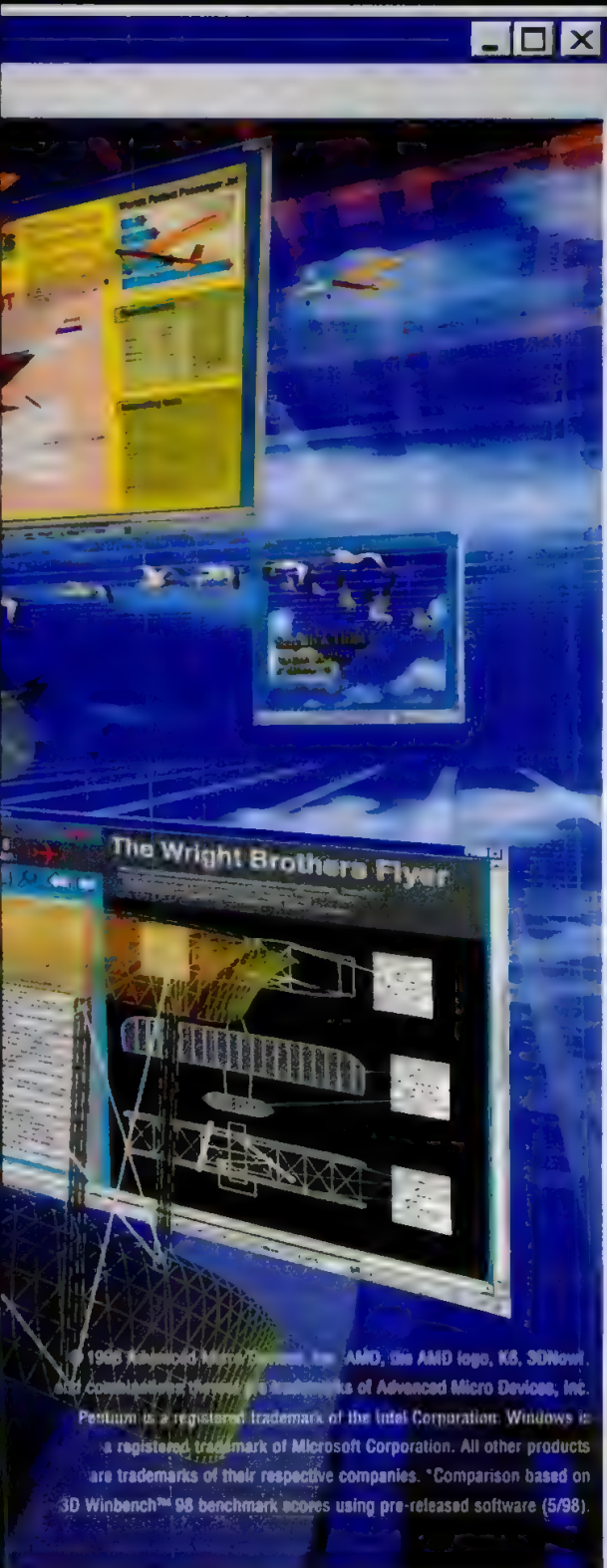
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Hard Disk Troubles



Be prepared and don't panic: Many errors are not fatal; you just have to know how to deal with them.

By Neil Randall

Of all the problems a PC can have, none is more frightening than a hard disk error. The problem could be as easy to deal with as a few bad sectors or a loose power connector, but whenever we see anything wrong with hard disk operation, our minds conjure up the horrifying phrase "disk crash." After all, most of us don't back up our data as often as we should, so a full disk crash could result in permanent losses. Even those who do regular backups will usually have to buy and install a new disk and then figure out the backup software's restore procedure. At the very least, it's a time-consuming and stressful procedure, and Murphy's Law ensures that these things happen only when deadlines loom and stores are closed.

Hard disks break down for the same reason cars or refrigerators break down: They're mechanical, and mechanical items are susceptible to physical problems. But hard disk failures can be more alarming, because they're more mysterious. We can tell an auto mechanic that the car isn't starting or the brakes aren't holding or the battery keeps going dead, and we tell the appliance repairperson that the fridge doesn't get cold. But with a hard disk, we rarely even know how to start assessing what's wrong. We know very well that the hard disk is inside the case, but the computer might report that the disk doesn't exist. As for what might still be on the disk itself, the only thing we can assume is: nothing at all.

Often, though, all your data isn't irretrievably lost. Hard disks can certainly go down for the count, but partial failures are possible, as are malfunctions that aren't actually disk problems at all. Here we'll look at a variety of disk problems, some reasons why they happen, and some ideas as to what to do about them.

YOUR HARD DISK AND YOUR DATA

First let's examine hard disk construction and operation. A hard disk comes packaged in an airtight container. This container prevents contaminants such as dirt, liquid, dust particles, and hair from coming in contact with the disk's *platters*, which are sealed inside. The platters themselves are composed of a *substrate* and a *magnetic medium*. The substrate, the platter's base material, is either aluminum or (more common today) glass or ceramic. The substrate material must be non-magnetic and capable of being machined to a smooth finish.

To allow data storage, both sides of each platter are coated with a magnetic medium, formerly *magnetic oxide* but now almost exclusively a layer of metal called a *thin-film medium*. The thin-film medium stores data in magnetic patterns, with each platter capable of storing a

USER TO USER



How to find the Windows 98 Easter egg; cleaning up shortcuts that programs add to the Windows Explorer *New* menu; troubleshooting a modem problem; setting up a Q and A format in Microsoft Word 97; freezing Excel's display during macro execution; printing summary and details from one report in Access; rolling your own manual for DOS 7; and more. *Page 243.*

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PC TECH



Many software authors want to add Internet capability to their applications, but writing and debugging all the code necessary to support the various Internet protocols can be daunting. We review four products that promise to take some of the pain out of the process. *Page 263.*

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billion or so bits per square inch (bps) of platter surface. To record and retrieve data, the hard disk assembly contains *read/write heads*. Each platter surface (top and bottom) typically has a corresponding R/W head, with each R/W head attached to a mechanical arm and all mechanical arms attached to a pivot. With the platters rotating around a *spindle* and the arms precisely positioning the heads, the entire structure is reminiscent of the good old record players gathering dust in many of our basements.

A main difference is that record turntables play only one of the stacked albums while the rest wait to drop into place, whereas in the hard disk assembly all of the platters are available at all times, and each has its own arms and R/W heads. Another difference is that the turntable's arm has no built-in intelligence; it simply holds the stylus, which is guided by the physical grooves of the album. In a hard disk assembly, the arm swings across the head according to instructions from a precise motor called an *actuator*; the platter itself does not guide the head. Instead, the actuator moves the R/W heads to the exact physical location of the data requested by the application.

There is yet another difference between record players and hard disks: While the stylus touches the vinyl album, the R/W heads float a few microinches above the platter. On early disks, this distance was 10 microinches or more, but today's R/W heads float at 5 microinches. The heads ride atop the airflow caused by the spinning of the platters, and except for a couple of circumstances, they never come in contact with the platters. If they did, they would damage or even destroy the data where they landed (hence the need for ultrasmooth platters and coatings).

The *planned* circumstance under which the heads touch the platters occurs when the disk stops spinning—that is, when the disk is powered off. During the *spin-down* period, the airflow diminishes and then stops completely, and the heads are no longer held off the platters. The *unplanned* circumstance occurs during a heavy shock of some sort, when the head cuts through the airflow and makes contact with the platter.

During a planned spin-down, the actuator guides the R/W heads to a dedicated spot called the *landing zone* (LZ). On older systems, as many of us remember, it was necessary to specify the LZ in the BIOS setup, but newer BIOSs can detect this information automatically. The LZ never contains data but is exclusively dedicated to providing a free

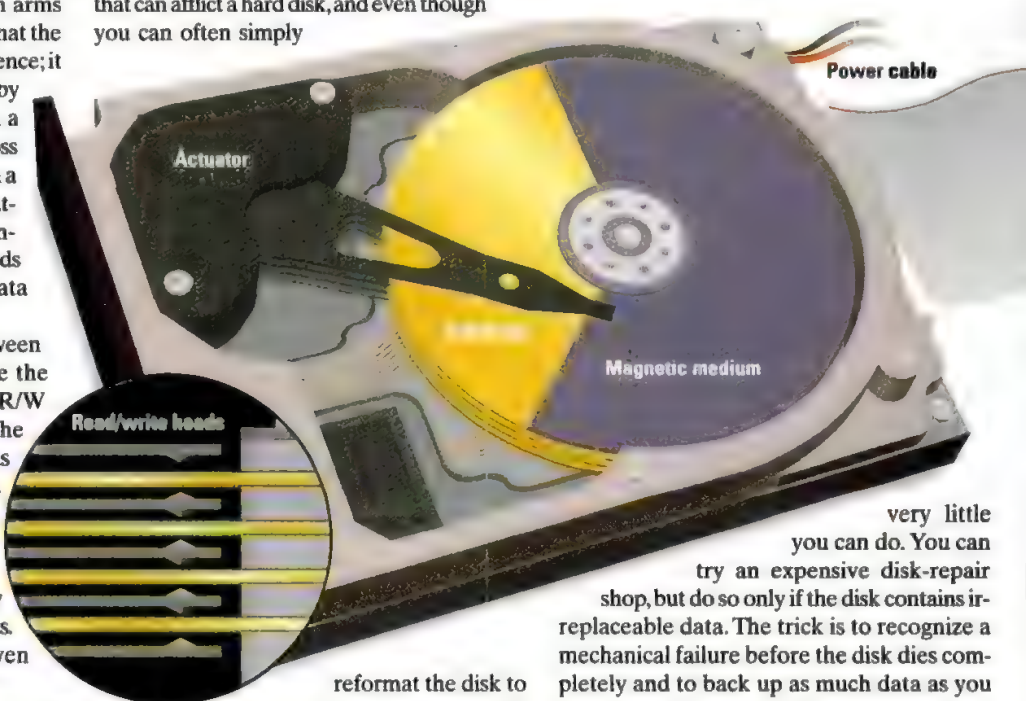
parking zone for the R/W heads. In fact, it was once necessary to type the park command to ensure that the heads would land in the right place, but today's disks park automatically.

The unplanned circumstance is known as a *head crash*, and such a crash can destroy data wherever the head touches (in a severe shock, the head can grind across a platter's entire surface). This is one of the most severe problems that can afflict a hard disk, and even though you can often simply

ogy and needs change so rapidly. But the fact is that some hard disks do fail, and any disk might.

As with all things that might fail, the best medicine is preventive. So back up your data and any programs for which you no longer have the installation disks. Ideally, back up your operating system as well so you can restore much faster than if you had to reinstall the OS. But the fact is many of us don't back up as often as we should, so a hard disk failure can result in considerable loss. Besides, it always seems a shame to toss several hundred megabytes of potential storage into the junk pile.

If your hard disk develops actual mechanical problems that stop it from working, there's



HARDWARE BASICS

Physically, a hard disk is analogous to a phonograph: A pickup on the end of a pivoting arm reads information from a spinning platter.

involving the actuator and other motors, but these are rare and nothing can really be done about them. A head crash can sometimes be repaired by special utilities or by a disk-repair shop, but some or even most data will always be unsalvageable.

ERRORS AND REPAIRS

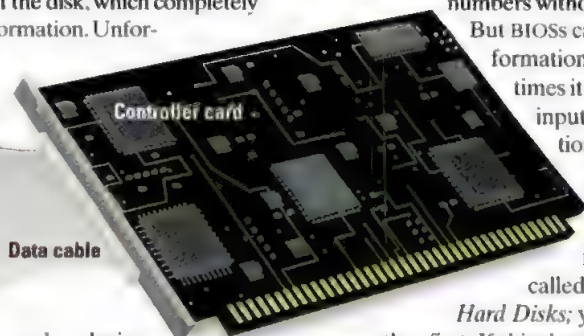
Like other computer hardware components, hard disks ship with a rating known as MTBF, or mean time between failures. The problem with MTBF ratings is that very few of us keep our hard disks—or even our systems—long enough to confirm MTBFs, simply because PC technol-

very little you can do. You can try an expensive disk-repair shop, but do so only if the disk contains irreplaceable data. The trick is to recognize a mechanical failure before the disk dies completely and to back up as much data as you can to tape, to floppy disk, or to another hard disk. And be sure to make a boot floppy disk, known in Windows 9x as a *start-up disk*, complete with drivers for your CD-ROM drive (Windows 98's start-up disks have generic CD-ROM drivers, Windows 95's do not). You'll need the CD-ROM for reinstallation of programs and perhaps for the OS itself.

The symptoms of a mechanically failing disk include strange noises (especially grinding noises), the appearance of data read or write errors, and disk reports (from ScanDisk or from utilities such as Norton Disk Doctor) that show increasing numbers of bad sectors. The last two on this list aren't necessarily the result of mechanical problems, but you should treat them as if they were for the sake of saving data. Once your data is safe, by all means try to repair the disk, but don't fully trust it until it behaves well for several months.

NOT DEAD YET

Sometimes what appears to be a mechanical problem isn't mechanical at all. Even in the case of read/write errors and reports of bad sectors, the problem might be the partial loss of disk information such as sector identification. Disk utilities such as ScanDisk isolate bad sectors and prevent the system from writing to them, so sometimes simply running one of these utilities will do the trick. But if degradation continues, the only solution might be a low-level format of the disk, which completely replaces sector information. Unfortunately, today's disks undergo low-level format-



ting only during manufacture, so this isn't usually an option. The disk itself, however, can often be reformatted by the manufacturer and returned to you. All your data, of course, is kaput.

Although being unable to access your hard disk inevitably causes panic, there are several things you can try before giving up. The relationship between the PC and the disk is complex, and any number of difficulties can result.

Physically installing a hard disk isn't difficult. Getting your computer to work with it, however, can be much more so. In the best-case scenario, you simply secure the hard disk container in a drive bay inside your PC's case, connect the power cable to the pins at the back of the disk, then connect the drive cable to both the disk and the system board. Turn on the machine and voila—a nice new disk with gigabytes of room to fill. But many things can go wrong.

The most common mistake in installing a hard disk is to reverse either one or both ends of the drive cable. One side of the cable is colored, usually red, and the colored strip should be on the same side as pin 1 on the disk. The same applies to the IDE controller on the motherboard (the pins are labeled, although not always clearly). If you see an error message on the screen saying, **HARD DISK ERROR** or **HARD DISK CONTROLLER ERROR**, this is likely what's happened. These connections can also become loose when you install other hardware inside the case, so check them first.

Even with the cables properly in place, the system might fail to recognize the hard disk. To recognize it, the system CMOS must have the disk's correct settings. You can see these settings in the standard configuration area of the

CMOS setup utility. When your system starts, it will probably tell you to press Del or another key or a key combination to enter this utility. Once there, you'll see each hard disk and its parameters: heads, cylinders, landing zone, and so forth. Without correct parameters, the hard disk and the BIOS can't talk to each other.

For older disks and older BIOSs, it was necessary to set these numbers manually, but for the past several years BIOSs have been capable of auto-detecting hard disks and supplying the numbers without your input.

But BIOSs can lose this information, and sometimes it's necessary to input the information again.

New BIOSs typically have a CMOS menu item called *Auto-detect*

Hard Disks; you should try that first. If this doesn't work or if your BIOS isn't capable of auto-detecting, you'll need to get the numbers and type them in. On disks made in the last three to four years, the numbers are often on the disk container itself. If not, you'll need to contact the manufacturer to get this information (often the company's Web site will have it), unless you've been sufficiently forward-thinking to keep the disk manual or print out the CMOS information.

Once you've entered the parameters, reboot the machine and go back into the CMOS setup to make sure the parameters have held. If they have, your disk should be available to your operating system. If not, try another disk if you have one to see if CMOS holds its information; if so, there's a good chance your disk has mechanically failed. If the system does not see the new disk, you might need to replace the motherboard. Another possibility is that the disk isn't receiving power, so you should try a different power connector (there's usually an unused one in most PC cases).

If during the boot sequence you see a message asking you to insert the boot disk, first check to ensure that you haven't left a non-boot floppy disk in the drive. If you haven't, then it's possible that the boot sector on your hard disk is corrupted. First, though, check the CMOS setup utility to ensure that the system is set to check the appropriate disk for boot information; CMOS can be set to tell your PC to check the A: drive (the floppy disk drive) first, then the C: drive, and on recent PCs even the CD-ROM drive. If everything here is fine, the problem could be in the boot sector. For whatever reason (a head crash is a possibility), the boot information

on the hard disk is damaged or lost. To check, boot from a floppy disk and see if you can then access the once-bootable hard disk. If you can, then the problem is quite likely with the boot information.

You can create new boot information by re-installing the operating system, which is possible if you can boot from your CD-ROM drive. (Put the Windows 95, NT, or 98 CD-ROM in the drive, change the CMOS setup to boot from the CD-ROM, and reboot.) If you can't boot from a CD-ROM, you can install Windows NT by using its boot floppy disks, or you can install Windows 98 from—believe it or not—a DOS 6.22 boot floppy disk. Make sure that the DOS boot disk lists your CD-ROM driver in *Config.sys* and Microsoft's CD-ROM driver (*Mscdex.exe*) in *Autoexec.bat*. Boot once to ensure that you can access the CD-ROM drive, then access the CD-ROM through the DOS command line and type *Run Setup.exe*.

If you install Windows NT as a solution to this problem, be sure to create a repair disk, either at installation time or later through Control Panel. The reason is that if you install Windows 95 or 98 later on, you'll no longer have access to Windows NT (except through a third-party boot-manager program). When that happens, boot from the NT installation floppy disks again and tell NT at the appropriate screen that you want to perform a repair. Fill in none of the options; just tell the installation program to keep going and Windows NT will establish a dual-boot screen.

There is another possible solution to the boot-sector problem, provided you have access to *Fdisk.exe* (on the boot floppy disk or in the Command directory on the hard disk): Type *Fdisk/MBR*. This command rebuilds the master boot record (hence the initials). This is precisely what to do if you've installed Linux and you no longer want to access LILO, the boot manager that Linux installs by default. *Fdisk/MBR* can work well, but it can also damage other files on the hard disk, so you should back up important files first.

A hard disk can encounter errors beyond those discussed here. In fact, we've dealt exclusively with problems that won't let you access the disk at boot time, not with errors such as accidental formatting or lost subdirectories. (We'll save those for another column.) The point is that disks can and do fail and that it's important to remember why and what you can do about failures, at least to start. As always, it's best to be prepared. ■

Neil Randall is a contributing editor of PC Magazine and the author of The Soul of the Internet (ITCP) and Special Edition Using Microsoft FrontPage98 (Que).

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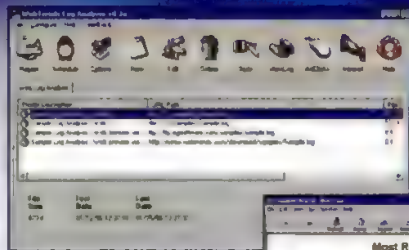
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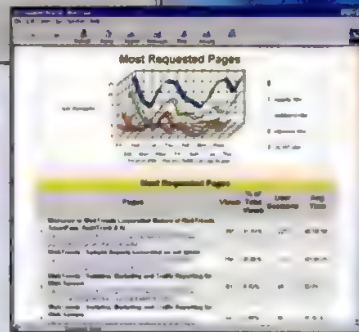
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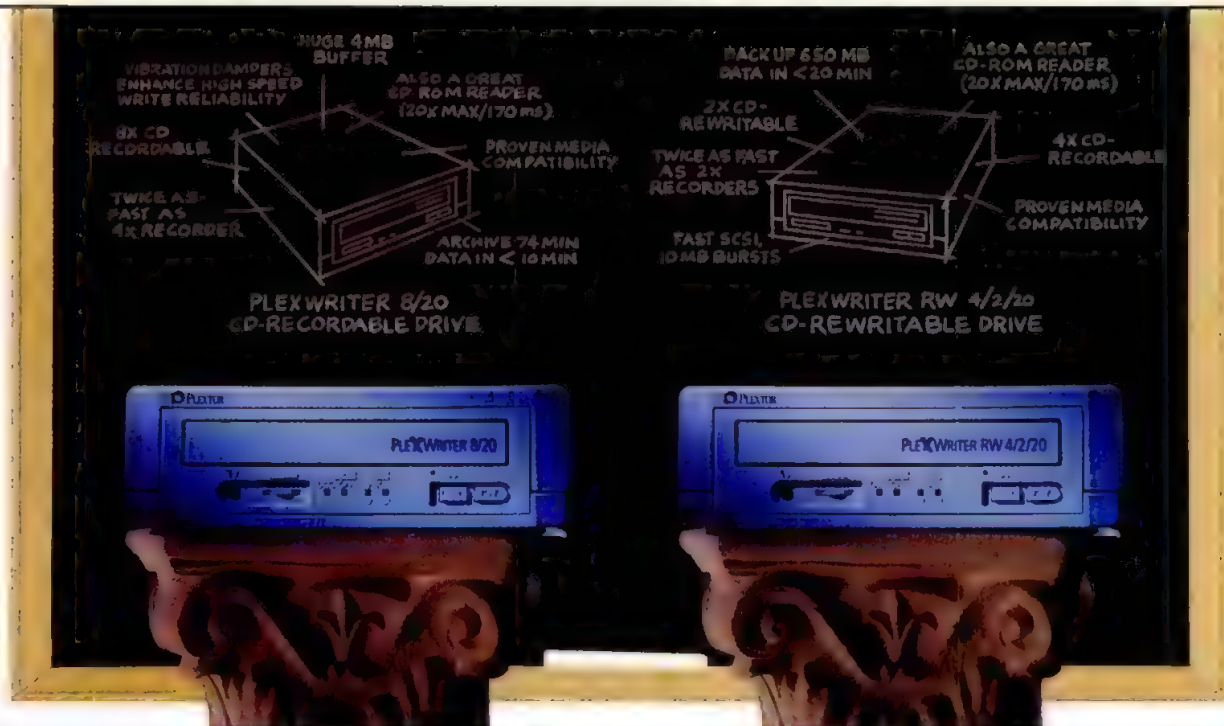
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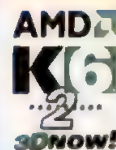
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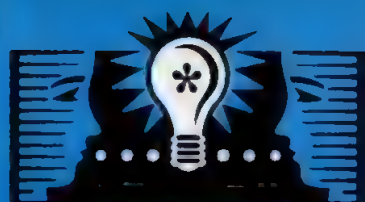


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USER TO USER

The Windows 98 Easter Egg

PC In order to launch the Windows 95 Easter egg, you had to create a new folder on the desktop and rename it repeatedly using three rather long text strings. Miss a punctuation mark and the procedure wouldn't work. The Windows 98 Easter egg, on the other hand, challenges your mouse-accuracy and knowledge of geography rather than your memory and typing skill. To invoke it:

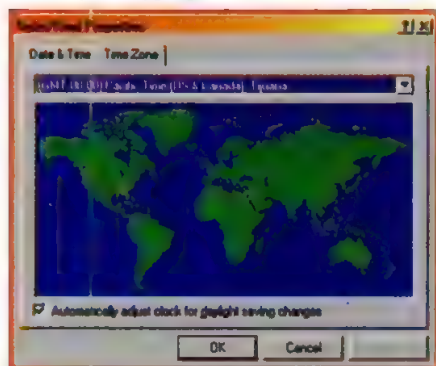


FIGURE 1: It's not easy to get the Windows 98 Easter egg to work. This shows you where to find Cairo, Memphis, and Redmond.

- Double-click the time in the taskbar.
- In the dialog box that appears, click the Time Zone tab.
- Place the mouse pointer over Memphis, Egypt. Hold down the Ctrl key, then the left mouse button. Move the pointer to Memphis, Tennessee. Release the mouse button, then the Ctrl key.
- Repeat the last step, this time moving from Memphis, Tennessee, to Redmond, Washington.

Figure 1 shows the three targets, right to left. Hitting the right spots may take a few tries. And don't think too hard about how much disk space the pictures and music are taking up.

—Neil J. Rubenking

What Does ScrollLock Do?

Here's something that has been bothering me for a long time: What exactly does the ScrollLock key do?

Sean Rutledge
via the Internet

PC Actually, it doesn't do anything except set an internal flag that says, "ScrollLock is on." It's not like Caps Lock or NumLock, which actually change the characters sent by the keyboard when you press particular keys. All it does is set a flag.

Programs that respond to the ScrollLock flag usually do so by changing the effect of the arrow keys. For example, in most spreadsheets the arrow keys move the little selection rectangle around to different cells. But with the ScrollLock on, the selection rectangle remains in the same cell, and the whole spreadsheet scrolls in the indicated direction.

If a program isn't written to pay attention to the ScrollLock flag, it won't have any effect. It really is different from Caps Lock and NumLock, so your question is a good one.—Neil J. Rubenking

Clean Up Explorer's New Menu

Right-clicking on the desktop brings up the desktop menu. At first, the New menu item contained only the submenu items *Folder* and *Shortcut*. Unfortunately, every time I install new software, the New menu item gains new submenu items that the software manufacturer deems important. This huge list actually makes things far less efficient. How can I remove the extra, undesired submenu items?

Steve Back
Peachtree City, Georgia

PC To clean up the New menu, you'll need to edit the registry. Be sure to follow the instructions below precisely, as a mistake in RegEdit can have disastrous consequences. Launch RegEdit and press Ctrl-F to bring up the Find dialog. Enter *ShellNew* in the text box, and check the *Keys* and *Match whole string only* boxes but not the other two boxes. When you find a *ShellNew* key, check the full key name shown in RegEdit's status bar. If it doesn't begin with *HKEY_CLASSES_ROOT*, your search is finished. Otherwise, check to make sure it has the form *HKEY_CLASSES_ROOT\...ext\ShellNew*, where .ext represents any file extension, including the initial period.

When you find a *ShellNew* key, determine what file type it belongs to. This is done by selecting the "parent" of the *ShellNew* key and looking at the default value shown in the right-hand pane (Figure 2). For example, on many systems the first key you find will be *HKEY_CLASSES_ROOT\...bfc\ShellNew*. When you highlight *HKEY_CLASSES_ROOT\...bfc*, you'll see "Briefcase" in the right-hand pane, so Briefcase is the file type.

If this is one of the file types you want removed from the New menu, right-click the *ShellNew* entry, select *Rename*, and change

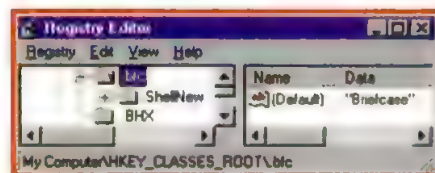


FIGURE 2: To remove a file type's entry in the New menu, locate the corresponding registry key and rename it from *ShellNew* to *ShellNewX*.

its name to *ShellNewX*. Press F3 to seek the next *ShellNew* key, and continue until you reach an item that doesn't begin with *HKEY_CLASSES_ROOT*. This change will take effect immediately; your New menu will be much smaller. If at some future time you want to restore one of the items you removed, simply search for it in the registry and change the name *ShellNewX* back to *ShellNew*.—Neil J. Rubenking

Where Did the Modem Go?

My modem connection has recently developed some problems. When I choose Control Panel, *Modems*, and *Diagnostics* and then click on *More Info*, Windows reports that the port could not be found. After trying a lot of different things, I decided to format and reinstall Windows 95. That

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solved the problem for a while, but now it has returned. The modem is an external model connected to COM2. The only other serial port in use is COM1 for a serial mouse. There are no IRQ conflicts reported in Device Manager. Do you have any suggestions?

Yves Girard
via the Internet

PC The fact that you're using an external modem helps simplify matters a bit, as this limits the problem to the serial port. The two most likely possibilities for the problem are that there is something physically wrong with the second serial port or that there is a problem in the port's configuration.

The first step is to make sure that your system has not been infected by a virus that is altering your CMOS configuration memory settings. That's unlikely, but it would be best to eliminate the possibility from the outset.

Once your system has a clean bill of health from a reliable virus scanner, the next step is to verify that the COM2 port is enabled. If it's integrated on the motherboard, check your CMOS settings to make sure it has been enabled. Then remove and reconnect the cable from the motherboard to the port's connector to make sure the cable is firmly in place. If the port is on a separate expansion card, make sure the card's jumpers are set correctly, then remove the card and reinstall it to make sure it's firmly seated in its expansion slot.

If none of this helps, disable or remove the port, and try another port instead. You can buy a simple serial port on an ISA card for as little as \$15 and a high-speed version for about twice that. Configure the port as COM2 and see if that solves the problem.
—Alfred Poor

Q&A Format in Word, WordPerfect

Court reporters need to alternate between questions, marked with a Q at the start of a paragraph, and answers, with an A at the start of a paragraph. In Corel WordPerfect, it's easy to set up Question and Answer styles, complete with the Q or A followed by a hard indent. If you chain the two together, you'll alternate between the styles when you hit Enter to start a new paragraph.

If you need to interrupt the flow of Q and A paragraphs—with an objection for example—you can start a new paragraph, hit backspace to remove the style from the paragraph, then type what you need to. To restart the chain, you simply start a new paragraph and choose the Q style or A style.

I haven't yet found an easy way to do the equivalent in Microsoft Word 97, nor has anyone I've talked to. Is there a way?

MaryJane Cooper
via the Internet

PC You can, indeed, do the same with Word 97 styles, although the details for both creating and using the styles are different than with WordPerfect. When you create a style in WordPerfect, you include text and formatting codes as part of the style contents. (I'll cover the details for WordPerfect after answering the question about Word.) When you create a style in Word, you're defining a format. However, you can include leading text as a bullet or number.

To create the Question style in Word, choose *Format | Style* and click on the *New* button. Enter *Question* as the *Name*, leave *Style Type* at the default *Paragraph*, leave *Based On* at *Normal*, and for the moment leave *Style for Following Paragraph* blank. From the same dialog, choose *Format*, then *Numbering* to open the *Bullets and Numbering* dialog box, and choose the *Numbered* tab.

Choose any number format, then *Customize* to open the *Customize Numbered List* dialog box. Choose *Font*, pick the font you want to use, then choose *OK*. Set the *Number Style* to none, and the *Number Format* to 0, followed by a period if you want one. You may also want to change the *Indent at* setting in the text position box, though the default 0.25 inch will serve for most purposes. Choose *OK*, then *OK* again to return to the *Style* dialog box.

Next, repeat these steps to create the Answer style. Enter *Question* as the *Style for Following Paragraph*, and customize a different numbering option in the *Bullets and Numbering* dialog box, using an A instead of a Q for the number format.

Once you finish defining the Answer style and return to the *Style* dialog box, you'll need to set the *Question* style to chain to Answer. Highlight *Question* in the *Styles* list, choose *Modify*, set *Answer* as the *Style for Following Paragraph*, and choose *OK*.

Once you've created the styles, using them is simple. To start the Q and A chain, start a new paragraph and from the *Style* drop-down list-box on the Formatting toolbar, choose *Question*. From then on, each time you hit Enter after finishing a paragraph, you'll start a new

paragraph that will alternate between the Question and Answer styles. If you move to the middle of a paragraph and hit enter, both newly formed paragraphs will use the same style. Similarly, if you need to break the chain, just choose *Normal* from the drop-down list.

By default, Word saves styles in the current document only. To save a style in the Normal template and make it available to other documents, choose *Format | Style*, highlight the style you want to add to the template, choose *Modify*, add a check to the *Add to Template* check box, and choose *OK*. The next time you start a new document, the style will be available to use.

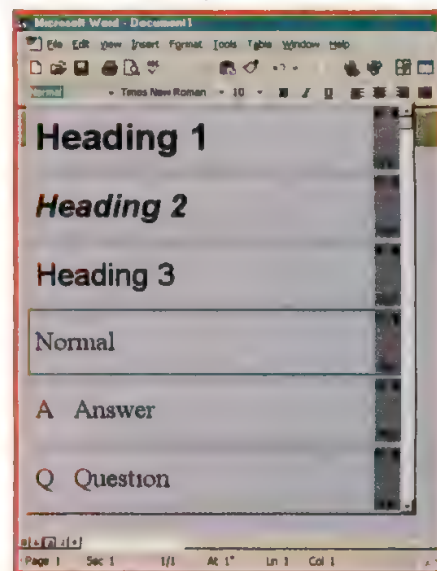


FIGURE 3: You can add new styles for Q and A formatting and choose them from this menu.

For WordPerfect users who don't already know how to do this in their program, it's worth taking a quick look at how to create the styles. These specifics are based on WordPerfect 7 commands:

To define the Question style, choose *Format | Styles* to open the *Style List* dialog box, then *Create* to open the *Styles Editor*. Enter a name—such as *Question*—in the *Style Name* text box, move to the *Contents* box, enter the Q (with or without a period), and hit F7 to enter the hard left indent. Finish by choosing *OK*. Then follow the same procedure to create the Answer style.

To chain the two styles, highlight either one while still in the *Style List* dialog box, then choose *Edit* to go to the *Styles Editor* dialog box. Make sure there's a check in the *Enter key will chain to* check box, and select the other style as the style to chain to, using the pull-down list below the check box. Then repeat the procedure for the other style. You should now be able to use the styles as Ms. Cooper describes in her letter.—M. David Stone

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Freezing Excel's Display During Macro Execution

I am writing several Microsoft Excel 97 macros that perform a lot of data manipulation among several graphs and worksheets. To speed up their execution, I would like to freeze the display of the worksheets and graphs while the macro runs. In Lotus 1-2-3 this can be done using {WINDOWSOFF} and {WINDOWSON} commands. Is there a way to do this in Excel? Please note: Application.Visible=False works, but has the disconcerting effect of making Excel disappear while False is set. Application.Sheets("Chart1").Visible=False doesn't work because it prevents my being able to select chart elements, such as the legend.

Jim McIntyre
Ravenna, Ohio

PC The property you're looking for is Application.ScreenUpdating. Setting Application.ScreenUpdating=False is equivalent to executing a {WINDOWSOFF} command in Lotus 1-2-3. As in 1-2-3, the screen returns to its normal behavior when macro execution ends. You can turn it on within the macro by setting the ScreenUpdating property back to True.—*Craig Stinson*

Printing Summary And Details from One Report

I'm in the process of converting hundreds of spreadsheet reports over to Microsoft Access 97. I currently produce spreadsheets containing dozens of accounts organized into five categories with a grand total. On the final page I show only the five categories and the grand total.

```
Private Sub Detail_Format(Cancel As Integer,
FormatCount As Integer)
' If ShowDetails check box on Sales by Year
Dialog form is cleared,
' don't print detail section.
```

```
If Forms!Sales by Year Dialog!ShowDetails
= False Then Cancel = True
```

```
End Sub
```

FIGURE 3: This code, from the Northwind Sales By Year sample report, demonstrates how to include or exclude detail lines in a report based on the choice a user makes in a dialog box.

I can print this in Access using two separate reports. Is there some way I can print the detail report and the summary report using only one report?

Phil Slates
via the Internet

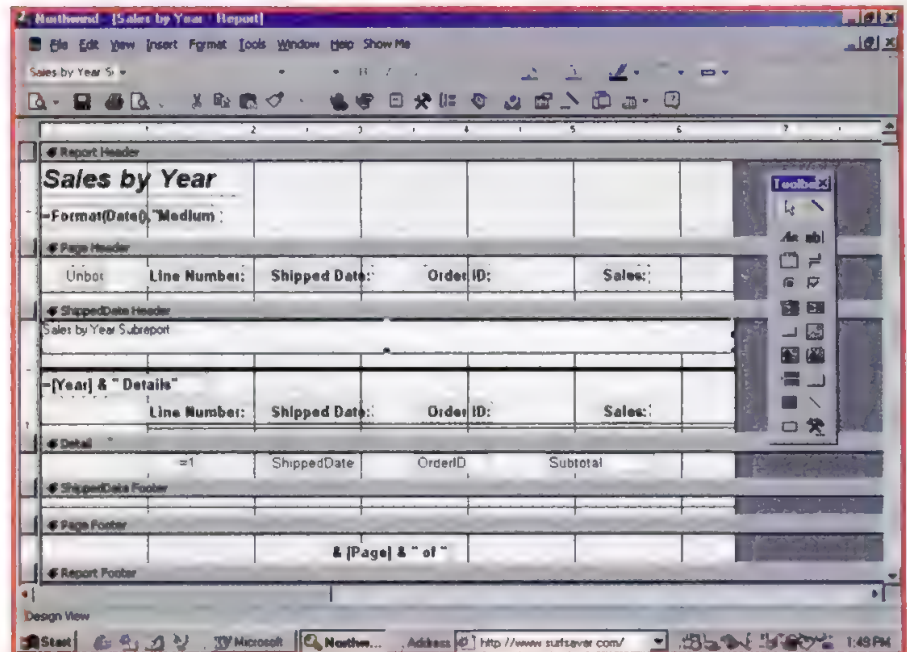


FIGURE 4: The Northwind Sales By Year report demonstrates how to use a subreport to embed summary information in your main report.

PC You can embed the summary report into the main report as a subreport. To see an example, take a look at the Sales By Year report in the Northwind sample database that ships with Microsoft Access. Figure 4 shows the report in Design view. The report is grouped by year and uses a subreport to show a sales summary in the group header. The summary is then immediately followed by more detailed information about each sale.

To do this in your own report, you'll have to give some thought to where you want the summary to appear. If the summary report summarizes all of the underlying data (as opposed to summarizing a grouping), then it's usually placed at the beginning or the end of the report. This means placing the summary in either the Report Header or the Report Footer. Start by opening the re-

port in Design view. The easiest way to insert the summary report in your main report is to drag it from the Reports tab in the Database window to the section where you want the summary to appear. Then position and adjust as necessary. Be sure to save the report when you're finished.

The Northwind Sales By Year report also demonstrates a useful technique you can use to let the user decide whether to include the detail lines in a report. When you run the report, a dialog appears with, among other

things, a Show Details check box. You check the box to include the detail lines or clear (uncheck) it to produce a summary-only report. Implementing this technique in your own report requires creating the dialog form and then placing code in the report's Open and Close events and the Detail section's Format event. The Open and Close events open the dialog form when the report is previewed or printed, and close it when the report is closed. The key to the technique is the code implemented in the report Detail section's Format event, shown in Figure 5.

The Detail section's Format event gets control when Access has data for a detail line in the report, but before the data is formatted and printed. As you can see from the code shown in Figure 5, you can accept or reject the detail line by setting the Cancel variable within the event procedure. Doing so based on the user's dialog box selection lets the user decide at runtime whether to include the detail lines.—*Sal Ricciardi*

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Build Your Own DOS 7 Manual

Anyone who regularly uses the command prompt in Windows 95 knows that the help provided on DOS 7 commands is pretty thin. What's even more frustrating is that there is no central help file; you have to type each command followed by a space, slash, and question mark. I wrote the batch file in Figure 1 in order to place all the online help for DOS 7 commands in one file that I could peruse at leisure or print.

The batch file must be named `Commands.bat`. The reason the name is hard-coded is because of the `SHIFT` command, which eliminates reliable use of the `%0` parameter: When the batch file finishes, it will start WordPad with a document containing the Windows 95 online help for all of the DOS 7 commands. Note that the batch file stores this document as `Dos7comm.doc` in the Temp folder. If you like, you can rename and move it.

For you batch file lovers, I'll detail how this file operates. The fourth line reexecutes `Commands.bat` under a secondary command processor with the environment set to 2048 bytes, passing it a flag value of `(){}()` on the command line. The enlarged environment is necessary because of the enormous environment variables. As a side benefit, when the secondary command processor terminates, all the environment changes are wiped out as well.

The next series of lines are `SET` statements that create four environment variables containing all of the DOS 7 commands that have online documentation. It was necessary to break them into four separate variables because of the command prompt 127-character limit. Several other environment variables are included merely to reduce repetitive typing and typos.

The line following the `SET` statements—`ECHO. > %TEMP%\45.0#%`—creates a blank file in the Temp folder. The entire batch file hinges on this file, because subsequently the batch file executes itself four different times with the various environment variables as parameters, starting over each time from line 1. The second line in the batch file tests for the existence of that blank file, and when



the file is detected, the batch file jumps down to the statements that follow the `:START` label. Without this test, the batch file would loop endlessly.

The six lines after the `:START` label create a header for the current command. The next line,

```
@ECHO OFF
IF EXIST %TEMP%\45.0#% GOTO START
IF '%1'=='()' GOTO Proceed
COMMAND /E:2048 /C COMMANDS.BAT {}{}()
GOTO END
:Proceed
SET COMMAND1=ATTRIB BREAK CALL CD CHCP CHKDSK CHOICE CLS
SET COMMAND1=%COMMAND1% COMMAND COPY CTTY DATE DEBUG DEL
SET COMMAND1=%COMMAND1% DELTREE DIR DISKCOPY 1
SET COMMAND2=DOSKEY ECHO EDIT EMM386 ERASE EXIT EXTRACT
SET COMMAND2=%COMMAND2% FC FDISK FIND FOR FORMAT GOTO IF
SET COMMAND2=%COMMAND2% KEYB LABEL LH MD MEM 2
SET COMMAND3=MODE MORE MOVE MSCDEX NLSFUNC PATH PAUSE
SET COMMAND3=%COMMAND3% PROMPT RD REM REN SCANDISK SET 3
SET COMMAND4=SETVER SMARTDRV SORT START SUBST TIME TYPE
SET COMMAND4=%COMMAND4% VER VERIFY VOL XCOPY
SET T=%TEMP%\().0#%
SET C=%TEMP%\DOS7COMM.DOC
SET LINE=*****
SET LINE=%LINE%%LINE%
SET LINE=%LINE%%LINE%
SET LINE=%LINE%%LINE%
ECHO. >%TEMP%\45.0#%
COMMANDS %COMMAND1%
:START
ECHO. > %TX%
ECHO %LINE% >> %TX%
ECHO. >> %TX%
ECHO %1 COMMAND ONLINE DOCUMENTATION >> %TX%
ECHO. >>%TEMP%\%1.0#%
ECHO %LINE% >> %TX%
ECHO M | %1 /? >> %TX%
ECHO. >> %CX%
ECHO. >> %CX%
TYPE %TX% >> %CX%
ERASE %TX%
SHIFT
IF "%1"=="1" COMMANDS %COMMAND2%
IF "%1"=="2" COMMANDS %COMMAND3%
IF "%1"=="3" COMMANDS %COMMAND4%
IF "%1"==" " GOTO OUTFLOOP
GOTO START
:OUTFLOOP
ERASE %TEMP%\*.0#%
START WORDPAD %CX%
:END
```

`ECHO M | %1 /? >> %TX%`, does much of the real work in the batch file. It redirects the on-screen help for the current DOS command to a file. The environment variable `%TX%` merely stands for a temporary file in the Temp folder. Note that I had to pipe a character into the command, because the `DOSKEY` command's help displays a screenful and then waits for you to type a character to continue.

I should mention that the `START` command's help will not redirect to a file. Since it's a new command, I suspect that a programmer at Microsoft

merely forgot to fix it that way, because `EXTRACT`—which is also new—will redirect successfully. I included the `START` command in the batch file anyway because it's always possible that different versions of Windows 95 will yield different results.

After processing one command, the batch file uses `SHIFT` to shift all command line parameters down by one and processes the next command. If the new first parameter is 1, 2, or 3, the batch file has reached the end of one of the command-collection variables, so it executes itself again to process the next variable. If the parameter is empty, then all the commands have been processed. The batch file finishes cleaning up after itself, launches WordPad with the completed document, and terminates.

Walter Zackery
via the Internet

PC A printed DOS manual is always reassuring, especially when things aren't going as they should. The document produced by `Commands.bat` has a very impressive look! You'll almost certainly want to move it from the Temp folder to a permanent home, perhaps in the `Commands` folder that resides within the Windows folder.

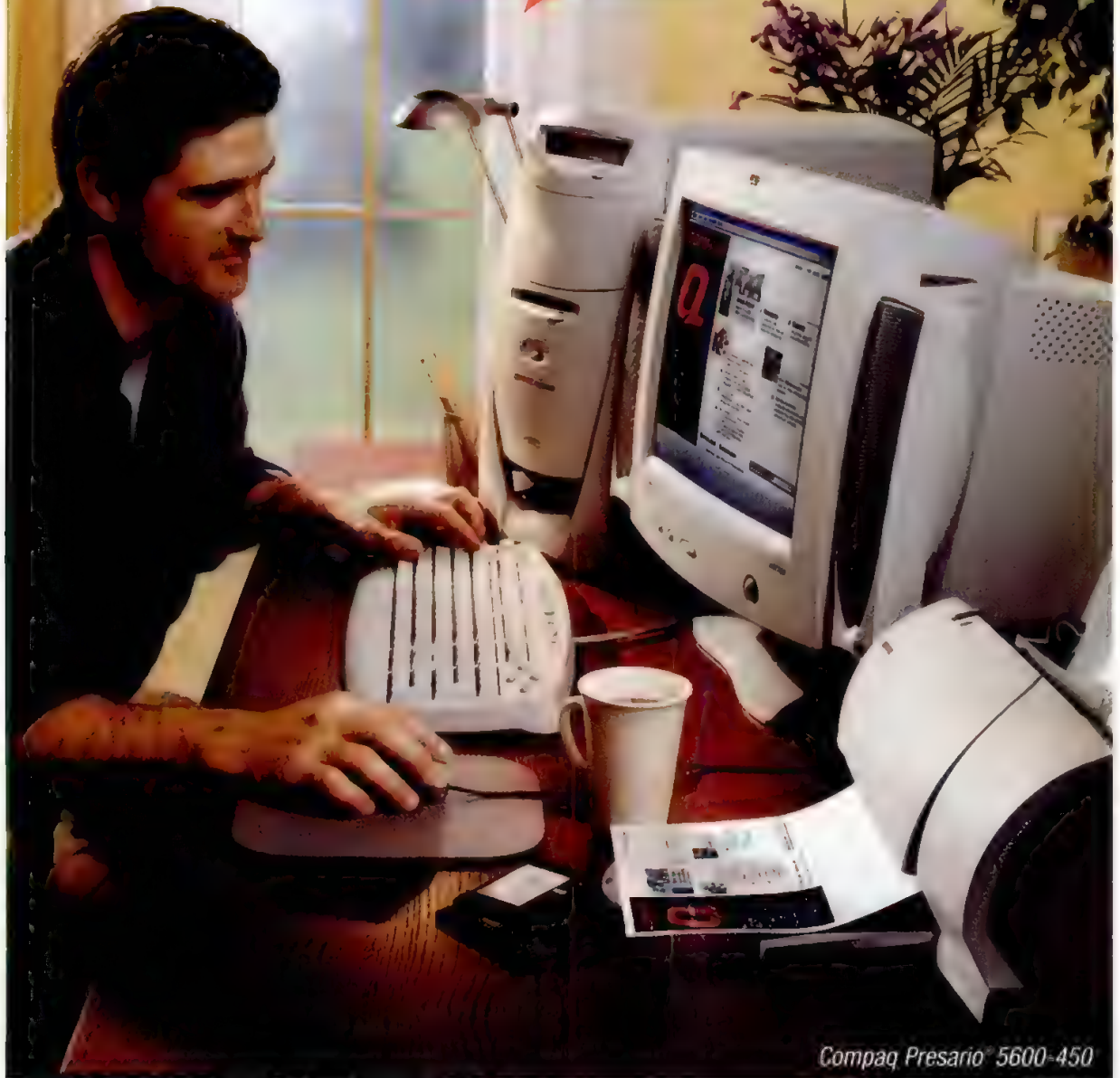
Don't attempt to run this batch file after booting to a DOS prompt, though. It will seem to work, though naturally WordPad will not start. But the help for a few commands, notably `XCOPY`, is not the same. Nearly a dozen of the switches available when `XCOPY` runs in a DOS box under Windows are missing after booting to a DOS prompt! Also, don't attempt to run the file under Windows NT. The Win NT command processor looks a lot like a DOS box, but it's different; likewise the command set.

—Neil J. Rubenking



FIGURE 6: This batch file generates a DOS 7 command manual that you can view or print.

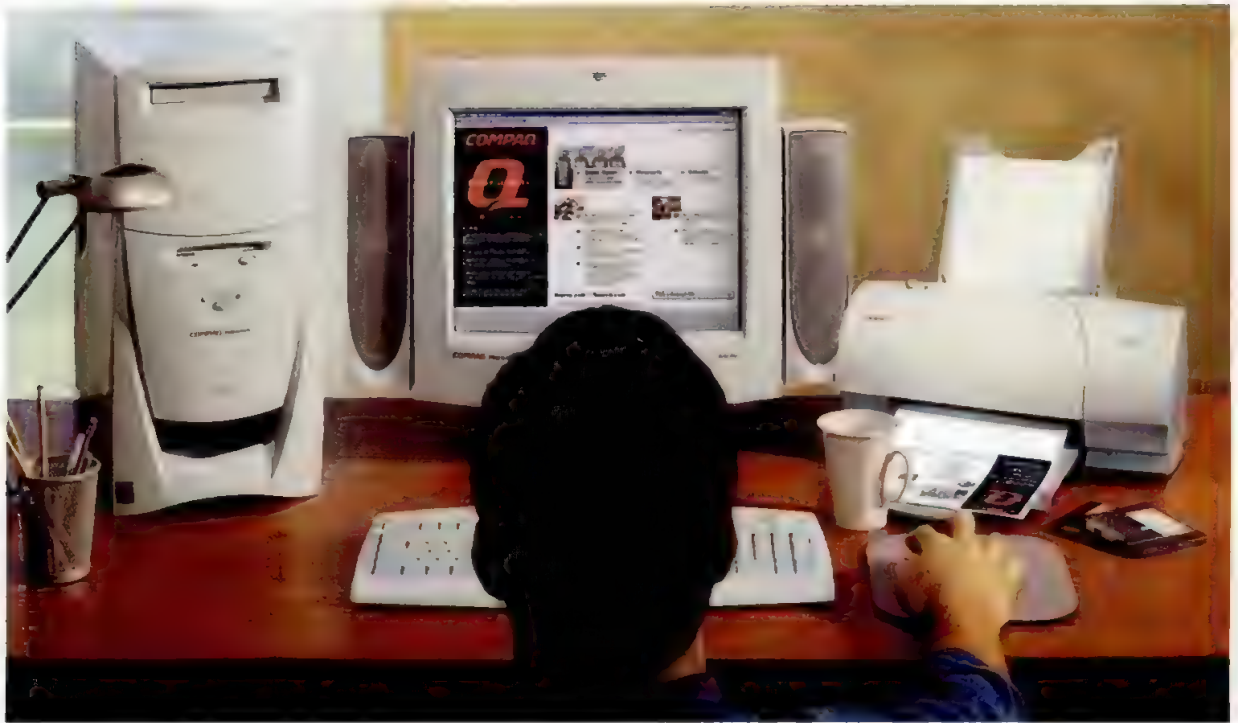
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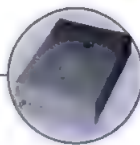
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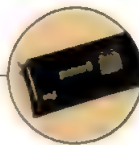
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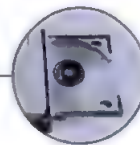
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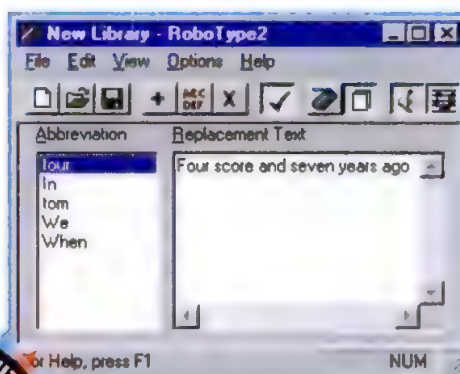
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An article about how to use RoboType 2 and how the program was written is available on our Web site at www.pcmag.com/download. A link to download the utility and its source code can also be found here.

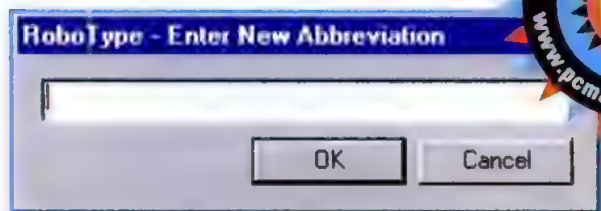
Gregory A. Wolking, author of RoboType 2, is the primary sysop of the ZNT:TIPS Forum on ZDNet/CompuServe and the PC Magazine Utilities discussion area on the Web. Sheryl Canter is editor of the Utilities column and a contributing editor of PC Magazine.



Most of RoboType's features can be accessed from a menu that pops up when you right-click the program's tray icon. You can switch libraries, turn options on and off, and exit RoboType.

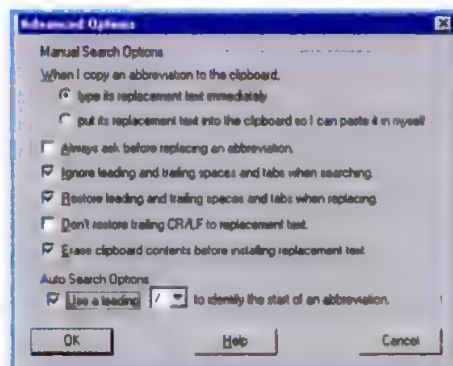


Double-click on the tray icon to open RoboType's main window. From here you can create new libraries of abbreviations and replacement text.



Clicking on the plus-sign button in the main window's toolbar brings up this dialog. Type a new abbreviation here and the replacement text in the right pane of the main window.

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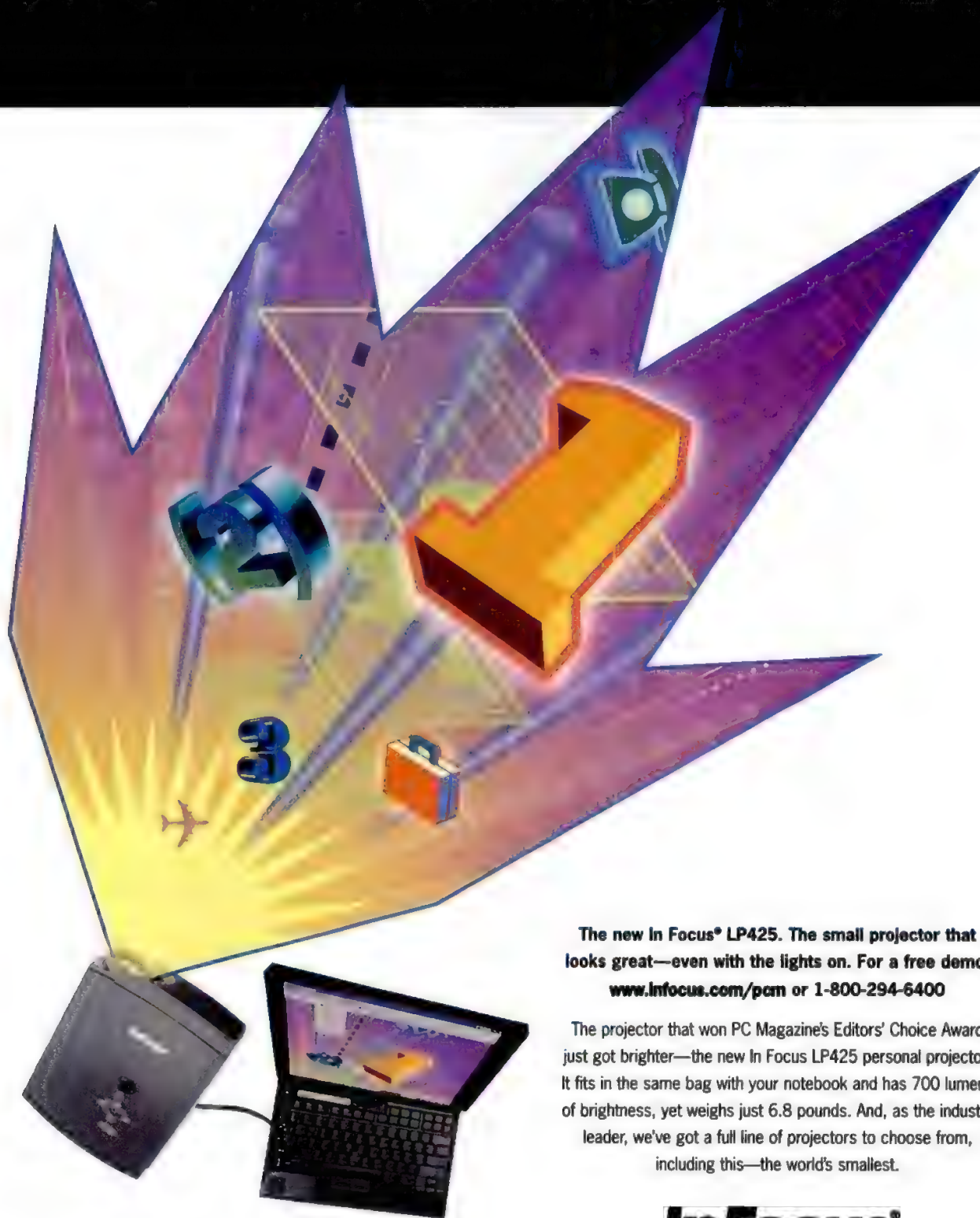
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Adding Internet Capability to Your Applications

By Steven E. Sipe

These days, Internet capability is a high priority for developers, many of whom are called on to create applications that can manipulate and retrieve data from widely distributed sources. Yesterday's single-data model has been replaced by a new collaborative-data model that allows the sharing of data no matter where it resides.

The Internet has become a key factor in distributed data sharing. It is built around a

Other languages seriously challenge Java in performance and robustness, however. In fact, several companies have used Java to develop large-scale applications only to find that the applications don't perform very well. And if you're developing programs with sophisticated user interfaces, you'll find Java's interface support somewhat limited compared with more mature tools such as C++, Delphi, and Microsoft Visual Basic.

In addition, Java just may not fill the bill should you need to add Internet support to an existing application. Unfortunately, you can't simply develop a Java-based DLL and call it from your C or C++ application; Java doesn't provide support for building machine- and OS-dependent items like DLLs, because the language isn't tailored for any specific type of hardware or operating system.

So if you want to develop an application that can take advantage of the Internet, you're essentially left with two options: The first is to rewrite your entire application in Java, and for some applications this approach may make the most sense. If you're considering this route, however, you should certainly also consider the scope of your application, so it won't fall victim to Java's less-than-stellar performance.

The second option is to add new Internet capabilities to an existing C or C++ application. The advantage to this approach, of course, is that it allows you to use your existing debugged code as a starting point. The downside is that Microsoft Windows provides support only for TCP/IP (Winsock) sockets, meaning you could end up writing thousands of lines of TCP/IP code to handle Internet protocols such as FTP and HTTP. Developing and debugging all that new code could take so much time and effort that

you would eventually lose any gains earned by modifying existing code.

Faced with such problems, seasoned developers often turn to third-party software packages. Java, the new kid on the block, may be stealing the headlines lately, but you'll find there's still plenty of serious, heavy-duty Internet development being done in good old C and C++. Thus you'll find a number of third-party packages that provide Internet support for C and C++ developers.

In this roundup, we look at four toolkits that allow you to add various types of Internet communications to C and C++ applications. Each toolkit provides components that handle protocols such as FTP and HTTP, as well as e-mail formats such as SMTP and POP3. Together, these components represent the equivalent of thousands of lines of code. In theory, that's also thousands of lines of debugged, well-tested, well-supported code, which rescues you from the hassle of writing, debugging, and supporting a huge amount of Internet communications code yourself. With less code to write, you might find time to turn your thoughts to loftier topics, such as making your company's proxy server work properly.

Catalyst Development Corp. SocketTools

SocketTools Version 2.15 is available in three different formats. Visual Edition (which we review here) consists of 19 16- and 32-bit ActiveX controls that work with Delphi, Microsoft Access, Microsoft Visual Basic, Microsoft Visual C++, and PowerBuilder, or in fact any tool that supports ActiveX controls. Library Edition provides many of the same controls, but packages them in the form of 14 16- and 32-bit DLLs that can be used with Delphi, Visual Basic, Visual C++, or any tool that supports DLL calls. Enterprise Edition combines Visual Edition and Library Edition into a single package, and also includes some additional features such as priority support and a two-developer license. All three versions allow royalty-free distribution of the SocketTools runtime components.

SocketTools Visual Edition is distributed on disk along with a six-page document that briefly describes each ActiveX control. The 16- and 32-bit components are packaged on separate sets of disks. After installing and rebooting, we found Visual Edition's group in the

Start menu and attempted to load the user's guide for the SocketWrench control, which provides a high-level wrapper for making Winsock TCP/IP

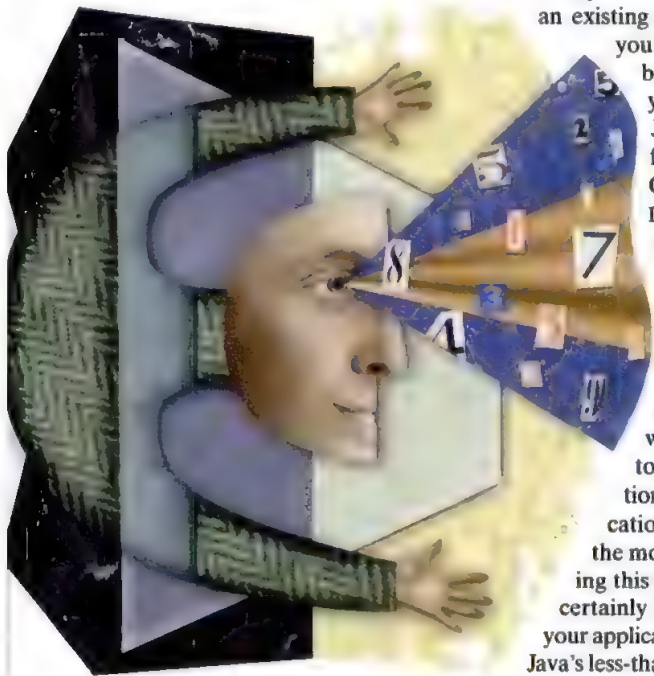
SocketTools Version 2.15.

List Price: \$247.

Catalyst Development Corp., Yucca
Valley, CA; 760-228-9653;
www.catalyst.com.

standard set of protocols, which allow the exchange of almost any type of information. For instance, an application can use SMTP to send an e-mail alert when certain error conditions occur, such as a full hard disk. Another application can use HTTP to monitor a Web site and download pages when they change.

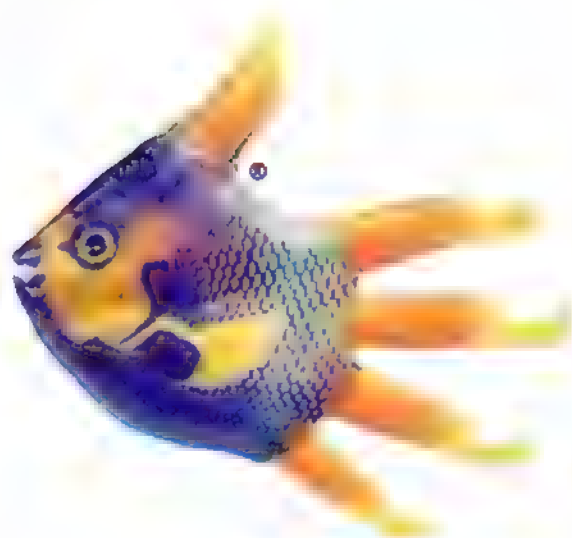
When people think of developing Internet-capable applications they often think of Java, in part because Java includes good support for various types of Internet communications.



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calls. Our first attempt failed because the guide was created using a version of Microsoft Word for Windows that isn't compatible with Windows WordPad. You'll need the version of Word for Windows in Office 97 (or later) to view the user's guide.

Once available, SocketWrench's forty-five-page user's guide proved to be an excellent resource. It relates in fairly good detail how to use the control, describing each of the control's methods and the errors each method might return. The text is pretty well written and should have you up and running with the SocketWrench control fairly quickly.

The clarity and depth of the SocketWrench user's guide left us with one puzzling question: Why doesn't SocketTools include this type of documentation for each of the 19 controls? It seems that Catalyst, like many other companies, has interpreted the concept of a *visual* edition to mean that printed documentation is no longer needed since visual configuration is available. Although this view does have some merit, the large number of guides and references available at bookstores for *visual* products such as Visual Basic and Visual C++ seems to indicate that many people still prefer to have printed information handy.

Our next task was to create a simple FTP client using the SocketTools FTP control. The code to create the FTP client was fairly straightforward (see Figure 1), but extracting the proper sequence of calls from the Visual Basic sample program required some detective work.

The first step in using the FTP control requires you to create the control's window object by calling `Create`; then you can set the host name, user ID, and password by calling the FTP control's `SetHostName`, `SetUserName`, and `SetPassword` methods respectively. If the supplied information is correct, you'll then have an active session with the specified FTP server. At this point, you can use any of the other available FTP client calls you desire. When you're ready to end the session, issue a call to the `Disconnect` method.

We also built a sample POP3 mail client that connects to a POP3 mail server. Again, the sequence of calls was straightforward. But just as with the FTP control, we had to search through one of the Visual Basic samples to find the necessary calls, and we had to construct our own header files based on definitions in the sample's headers.

In short, SocketTools has a lot of potential. The controls performed well and are straightforward to use for the most part, and you can't beat the package's low price



and royalty-free distribution policy. (Note that the SocketWrench control can actually be downloaded and used for free.) But SocketTools could use some improvement in a couple of areas. The concept of a *visual* tool really works best with tools that are primarily visual in nature, like edit controls, buttons, and so forth. But because very few control properties can be configured visually, you have little choice but to write code to manipulate many properties. Since this is the case, more thorough documentation for each control method would certainly be welcome.

SocketTools could also use better support for multiple programming languages. The package claims support for several but provides sample programs and header files only for Visual Basic, meaning you're left with the job of converting the headers and samples to your language of choice yourself if you're not using Visual Basic. Unfortunately, even SocketTools' good performance, low price, and generous distribution policy can't make up for this shortcoming.

Dart Communications PowerTCP

PowerTCP Version 4.0 gives you the ability to construct TCP/IP applications from components. The toolkit is distributed in the form of 16- and 32-bit DLLs as well as 16- and 32-bit library files. The libraries and DLLs work with both Borland C++ and Microsoft Visual C++, and there are also separate versions of PowerTCP available for Delphi, Microsoft Visual Basic, and PowerBuilder.

PowerTCP's distribution policy is the most restrictive of any of the libraries in this roundup, allowing royalty-free distribution only within your company. In other words, if you're developing a commercial product for yourself or a client, you'll have to purchase a distribution license for PowerTCP's runtime components or join Dart's Partner Licensing program. And the company offers a free trial, but it too is more restrictive than most. You download the program, then submit a request for a seven-day evaluation license key. The company does say you can e-mail requests to extend the evaluation period.

The PowerTCP toolkit is distributed on four floppy disks, three containing library components for Microsoft Visual C++ and other components for Borland C++ 5.02. We found the installation to be quick and smooth.

Editors' Choice

Dundas Software Ultimate TCP/IP



Each of the tools in this roundup provides strong support for building Internet-capable applications.

With the exception of Microsoft's WinInet, which is somewhat limited in scope, all of these packages support a broad range of Internet protocols, allowing you to add Internet communications to your C or C++ applications fairly quickly.

What distinguishes these packages is the quality of the sample programs, the thoroughness of documentation, and the runtime distribution policies, and Dundas Software's Ultimate TCP/IP Version 2.1 earns the nod in each category. This toolkit includes a variety of helpful sample programs as well as a fairly complete reference manual. Ultimate TCP/IP's components are stable and perform well, and the royalty-free distribution policy is a substantial benefit.

Dundas's inclusion of source code for

many of the components and tools is icing on the cake. Having the source offers you the greatest amount of flexibility, because it lets you incorporate components directly into your applications, thus avoiding problems with DLL version mismatches. This is clear evidence of Dundas's solid support for developers.

An honorable mention goes to WinInet. Although this package provides support for only three protocols, each is solidly implemented and performs quite well. For simple applications that require only FTP or HTTP communications, WinInet is certainly a viable option. It's somewhat weak in the area of sample programs and documentation, but that's more than compensated for by its free price.

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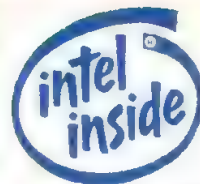


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PC TECH

The documentation included with PowerTCP certainly won't win any awards for thoroughness. You get an 8.5- by 11-inch spiral-bound manual that contains only 97 pages—a rather anemic companion for such a heavy-weight toolkit. As you might imagine, this small number of pages couldn't possibly begin to describe PowerTCP's extensive collection of 15 components. In fact, the manual devotes very little specific coverage to the components. There are no function prototypes or descriptions of function parameters. Much of the manual offers only general information about each component.

Perhaps to address the manual's weaknesses, Dart includes a coupon for a free copy of the book *TCP/IP Clearly Explained*. It is a well-written book that does an excellent job describing what TCP/IP is all about, but unfortunately, it isn't an adequate substitute for PowerTCP's lack of documentation. This is like buying a new car and receiving an automotive dictionary in place of the owner's manual: There's plenty of general information, but not much specific assistance.

Luckily, PowerTCP's sample programs and

online help compensate to some extent for the rather poor documentation. For example, the FTP sample program contains the source code for a fairly complete FTP client program (see Figure 2). The primary goal of any sample

program is to teach by example. For that to be effective, the sample code must be well organized and well commented, and it should demonstrate how to use many of the component's features. In this respect, Power-

TCP's sample programs do a fairly good job. They provide code for using many of each component's methods. The samples are also well organized and generally easy to understand. A few more comments would have been helpful, but in most cases the code is easy to follow even without comments.

Building an FTP client program using PowerTCP's FTP class is simple and quick. First

you derive your own class from the

CPowerFTP class. Deriving your own class allows you to add any specific event handlers you require. For example, you might want to add an event handler that's called when a block of data is received from the FTP server. After deriving the class, make a call to the `LoginHost` specifying the user ID and password. If all goes well, you then have an active FTP session, and you can use any of the available FTP calls such as those to transfer files, change directories, and so forth. A call to the `Logout` and `Close` methods ends the server's session.

PowerTCP performed well. The 15 sample programs included do a very good job of demonstrating how to use each of PowerTCP's components. The client programs built with each component performed well and were very stable. Unfortunately, PowerTCP's poor documentation and rather restrictive distribution policies are good reasons to look elsewhere.

PowerTCP Version 4.0.

List Price: \$598.

Dart Communications, Syracuse, NY;
315-431-1024;
www.dart.com.

Ultimate TCP/IP Version 2.1.

List price: \$499.

Dundas Software Ltd., Lewiston,
NY, 800-463-1492;
www.dundas.com.

Dundas Software Ltd. Ultimate TCP/IP



Dundas Software's Ultimate TCP/IP Version 2.1 represents a radical departure from the other products in this roundup. Although it supports many of the same protocols, the package takes this support to a whole new level. For example, Ultimate TCP/IP includes the complete C++ source code for almost every component in the toolkit. And it provides the source code for Active Template Library (ATL) ActiveX versions of several components.

Furthermore, you'll find Ultimate TCP/IP's distribution policies to be very developer-friendly. Ultimate TCP/IP grants a license for royalty-free distribution of its runtime components, and you are also allowed to package the components in any fashion you desire, as long as you don't make them into another Internet communications toolkit.

Controlling the packaging of components offers a tremendous amount of flexibility. For example, you can combine the components into ActiveX controls, DLLs, and so forth. Dundas even encourages linking

the toolkit's C++ files directly into your project, and each component's source files are actually small enough to make this approach feasible. Linking components directly into your application eliminates the versioning headaches often associated with distributing DLLs.

The toolkit is distributed on a CD-ROM, which contains the complete source code for each of the components as well as several sample programs. You also get the source for a couple of demo programs that illustrate how to use Ultimate TCP/IP components in full-featured applications. One of the sample programs, for example, demonstrates how to build a list mailer.

Ultimate TCP/IP's manual isn't the most professional in appearance: It's a blue three-ring binder containing 8.5- by 11-inch sheets. Despite its rather unprepossessing appearance, the manual is fairly well written and does a pretty good job explaining how to use each Ultimate TCP/IP component. The manual is divided into three distinct sections. The first provides a brief introduction to the various types of Internet communication protocols. The second contains tutorials that step you through implementing clients for each of the various protocols. The final section describes the available methods for each of UL-

// SocketTools sample ftp client file download

```
CFtpClient ftp;
CRect rc;
```

```
// Create an instance of the ActiveX control
ftp.Create(NULL, "test", 0, rc, this, 999);
```

```
// Set the remote host's name
ftp.SetHostName("ftp.zdnet.com");
```

```
// Set the user ID and password
ftp.SetUserName("anonymous");
ftp.SetPassword("ses");
```

```
// Attempt a connection
short sRet = ftp.Connect();
```

```
// Did it work?
if(sRet == 0)
```

```
{
    // Yes...get the remote file "index.txt"
    ftp.GetFile("e:\\pcmag\\index.txt", "index.txt");
```

```
// Disconnect the session
ftp.Disconnect();
}
```



FIGURE 2 SocketTools FTP component makes building an FTP client program a breeze.

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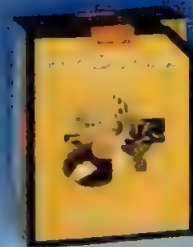
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time TCP/IP's components.

Ultimate TCP/IP includes a good collection of sample programs; for example, one implements an FTP client. What's really interesting and useful, though, is that in addition to each client sample program you'll also find a sample server program. That's because Ultimate TCP/IP supports not only building client applications but also building servers (see Figure 3). And for example, Ultimate TCP/IP's FTP server code implements a fairly robust FTP server. This sample code can really come in handy if you need to know what's happening on the other side of an FTP client connection. Of course, its biggest advantage is that you can use it to test your client programs even when you're not connected to the Internet.

Building an FTP client program using Ultimate TCP/IP is quick and easy. All you really have to do is follow the second section of the manual, which does an excellent job guiding you through each of the necessary steps. This section describes each aspect of building the client, from creating your project to choosing which Ultimate TCP/IP header files to include. The first step in connecting to the FTP server involves calling the CUT_FTPClient class's Connect method and supplying a host name, user ID, and password. If successful, you'll then have an active session with the FTP server. At this point, you can use any of CUT_FTPClient's available methods. You may wish to use the ChDir method to change the FTP server's directory, for example. When you've finished with the server session, a call to the Close method closes the connection.

We found Ultimate TCP/IP to be a solid package that performs very well and provides excellent value. The sample programs are clearly written and do a good job describing each of the toolkit's components. And the inclusion of sample programs to build servers for each protocol is an added bonus. If the icing on the cake is Dundas's generous distribution policy, then the inclusion of the complete source code for each component is the cherry on top. Every aspect of Ultimate TCP/IP, in fact, seems geared toward making life easier for developers.



Microsoft Corp. WinInet

The initial release of Microsoft Windows 95 did not include support for Internet communications, but Microsoft Internet Explorer later introduced a new component that has since become part of the standard Windows distribution. The heart of Internet Explorer's communications routines is Microsoft's WinInet DLL. WinInet is a system-level DLL that provides operating system-level support for several Internet communications protocols. This support is available not only for use by Internet Explorer, but also by any Win32-based application.

WinInet supports only three communication protocols: FTP, HTTP, and Gopher. But though it's limited in scope, WinInet's support for these three protocols is well implemented and

since become part of the standard Windows distribution. The heart of Internet Explorer's communications routines is Microsoft's WinInet DLL. WinInet is a system-level DLL that provides operating system-level support for several Internet

WinInet.
List price: free with Microsoft Internet Explorer.
Microsoft Corp., Redmond, WA;
800-426-9400;
www.microsoft.com.

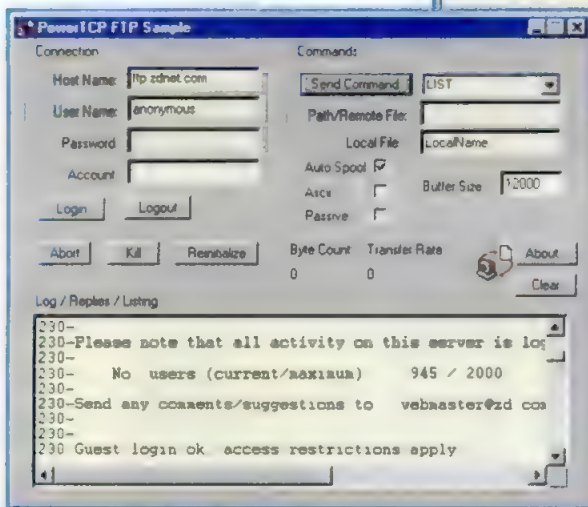


Figure 2. PowerTCP's fully functional FTP program demonstrates how to use PowerTCP's FTP library calls.

very stable. Microsoft's Visual C++ compiler provides the necessary WinInet headers and libraries along with some MFC classes that encapsulate WinInet. If you're using another vendor's C++ compiler, you can download the Internet SDK from Microsoft's Web site to obtain the header and import libraries necessary when using WinInet.

Although you can't directly distribute

WinInet with your applications, your users probably have a copy already if they're running Windows 98, Windows 95 OEM Service Release 2, or Windows NT 4.0. The Windows 95 Plus pack also contains WinInet, and it is included with Internet Explorer 3.0 and later.

Visual C++ provides several sample programs that demonstrate how to use the three protocols WinInet supports. The samples are fairly simple and aren't very well commented. In spite of this, they're probably adequate for getting you acquainted with the basics of WinInet. If you need more sample programs than those provided by Visual C++, you can find a few more on Microsoft's Web site.

Building an FTP client with WinInet is fairly easy. If you're going the MFC route, it's simply a matter of instantiating a CFTPConnection object using the CInternetSession class. CInternetSession handles the basic operation of establishing a session with the FTP server using the provided host name, user ID, and password. Once you've established the session, you can use CFTPConnection to

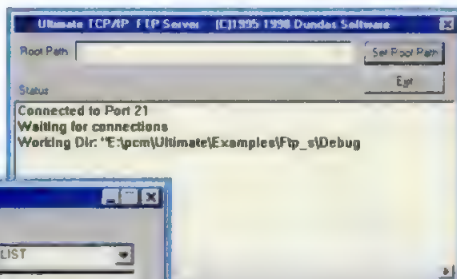


Figure 3. Dundas Software's Ultimate TCP/IP also includes code to build servers, such as this FTP server.

perform the actual FTP client operations. For example, you can use the SetCurrentDirectory method to change the directory on the FTP server. A call to the Close method terminates the session when you've finished.

WinInet also provides a set of HTTP routines that allow you to retrieve Web pages. These routines work in a similar fashion to normal file operations. For instance, you can call the Win32 WinInet API InternetOpenURL to open a page on a Web server. Next you can use the InternetReadFile call to retrieve the page's data. When you've finished, calling InternetCloseHandle releases any working memory and terminates the HTTP session.

For simple applications, Microsoft's WinInet routines might suit your needs; you certainly can't complain about the distribution policies or cost. If you're mainly looking for a way to integrate file downloads or custom Web page retrieval, then WinInet's support should be more than adequate. But if you need more sophisticated communications capabilities, such as handling POP3, SMTP, or MIME encoding, then you're better off investigating one of the other toolkits in this roundup. **PC**

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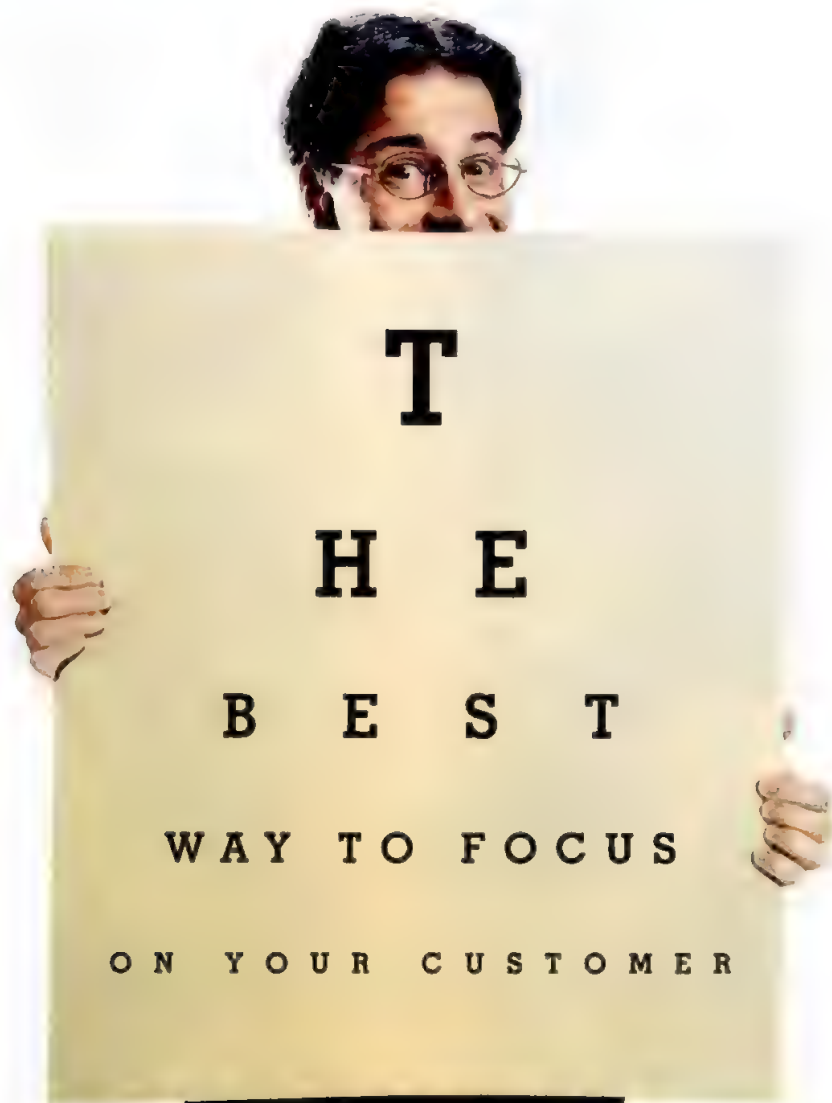
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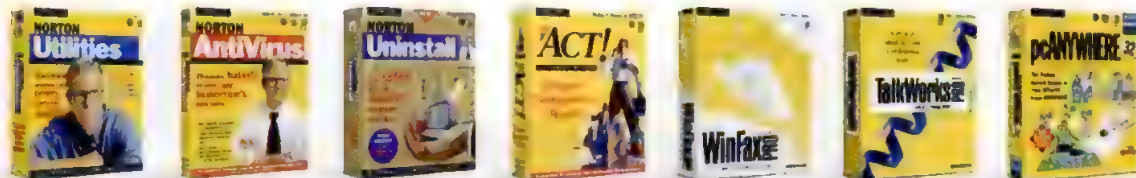
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Armada 1573

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\$1,599*

Leasing Price: \$54/Month¹

- Mobile Intel Pentium Processor with MMX™ technology 233 MHz
- 3.2 GB² SMART Hard Drive
- 32 MB RAM (expandable to 96 MB)
- 12.1" CSTN SVGA display
- 20X Max³ CD-ROM
- K56flex modem⁴
- Integrated AC Adapter
- Li-Ion battery
- 1-year limited warranty⁵

Armada 1700

The fully integrated notebook from Compaq that combines the latest key technology with uncompromising value.

\$2,799*

Leasing price: \$95/Month¹

- Mobile Intel Pentium II Processor 266 MHz
- 4.0 GB² SMART Hard Drive
- 32 MB SDRAM (expandable to 160 MB)
- 13.3" TFT (1024 x 768) display
- 24X Max³ CD-ROM, optional DVD
- K56flex modem⁴
- Integrated AC Adapter
- Multibay design
- 1-year limited warranty⁵



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- Intel Celeron™ Processor 300A MHz
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- 32 MB SDRAM
- Compaq S700 17" (15.7" viewable) monitor
- Matrox MGA AGP Graphics
- Towerable chassis converts from desktop to minitower
- 3-year limited warranty⁶

Model 6350/10000/CDS

Provides the latest in performance technology in a simple, flexible design that configures to the workplace. The option is open for either a desktop or minitower system.

\$1,979*

Leasing price: \$67/Month¹

- Intel Pentium II Processor 350 MHz
- 10 GB² SMART II Hard Drive
- 64 MB SDRAM
- Compaq S700 17" (15.7" viewable) monitor
- Matrox Millennium AGP Graphics with 8MB VRAM
- 32X Max³ CD-ROM
- Towerable chassis converts from desktop to minitower
- 3-year limited warranty⁶

Model 6450/10000/CDS

Delivers true value by providing the ultimate in desktop quality and reliability. It offers a broad range of innovative, cost-effective, and flexible solutions.

\$2,239*

Leasing price: \$76/Month¹

- Intel Pentium II Processor 450 MHz
- 10 GB² SMART II Hard Drive
- 64 MB SDRAM
- Compaq S700 17" (15.7" viewable) monitor
- Matrox Millennium AGP Graphics with 8 MB VRAM
- 32X Max³ CD-ROM
- Towerable chassis converts from desktop to minitower
- 3-year limited warranty⁶

Options

Deskpro EP Series:

- Additional 32 MB SDRAM Memory: **\$79***
- 32X Max³ CD-ROM: **\$139***
- Upgrade to Compaq S900 19" (18" viewable) monitor: **\$220***
- SuperDisk LS-120 Drive: **\$119***
- Compaq C-Series 810 Handheld: **\$499***



Compaq Armada Notebooks

Armada 3500

The lightest notebook from Compaq, weighing only 4.4lbs.

\$2,799*

Leasing price: \$95/month¹

- Mobile Intel Pentium II Processor 266 MHz
- 4.1 GB² SMART Hard Drive
- 32 MB RAM (expandable to 160 MB)
- 12.1" TFT SVGA display
- 512 KB L2 Cache
- Optional CD-ROM or DVD via Mobile Expansion Unit
- 4.4 lbs. and 1.3" thin
- Magnesium display for durability
- 3-year limited warranty⁶

Armada 7400

The lightweight, durable notebook delivering a combination of high performance, desktop equivalence, and mobility.

\$3,999*

Leasing price: \$136/month¹

- Mobile Intel Pentium II Processor 300 MHz
- 6.4 GB² SMART Hard Drive
- 64 MB SDRAM (expandable to 256 MB)
- 13.3" TFT (1024 x 768) display
- Powerful AGP graphics
- 24X Max³ CD-ROM
- Optional ArmadaStation Expansion Base
- Around 6 lbs. and only 1.6" thin
- Magnesium casing for durability
- 3-year limited warranty⁶



Compaq Servers

ProLiant 800

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Leasing price: \$105/Month¹

- Intel Pentium II Processor 350 MHz
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- 10/100 TX UTP (embedded) Ethernet Controller
- 24X Max³ CD-ROM
- Compaq Insight Manager, SmartStart⁵
- Compaq V55 15" (13.7" viewable) monitor, with 1-year warranty⁶
- 3-year on-site limited warranty⁶

Options

Armada 1700:

- Compaq Value Case: **\$49***
- 32 MB Memory Module: **\$89***

Armada 3500:

- Mobile Expansion Unit 24X Max³ CD-ROM: **\$199***
- Mobile Expansion Unit with DVD: **\$399***
- Additional Li-Ion battery: **\$209***

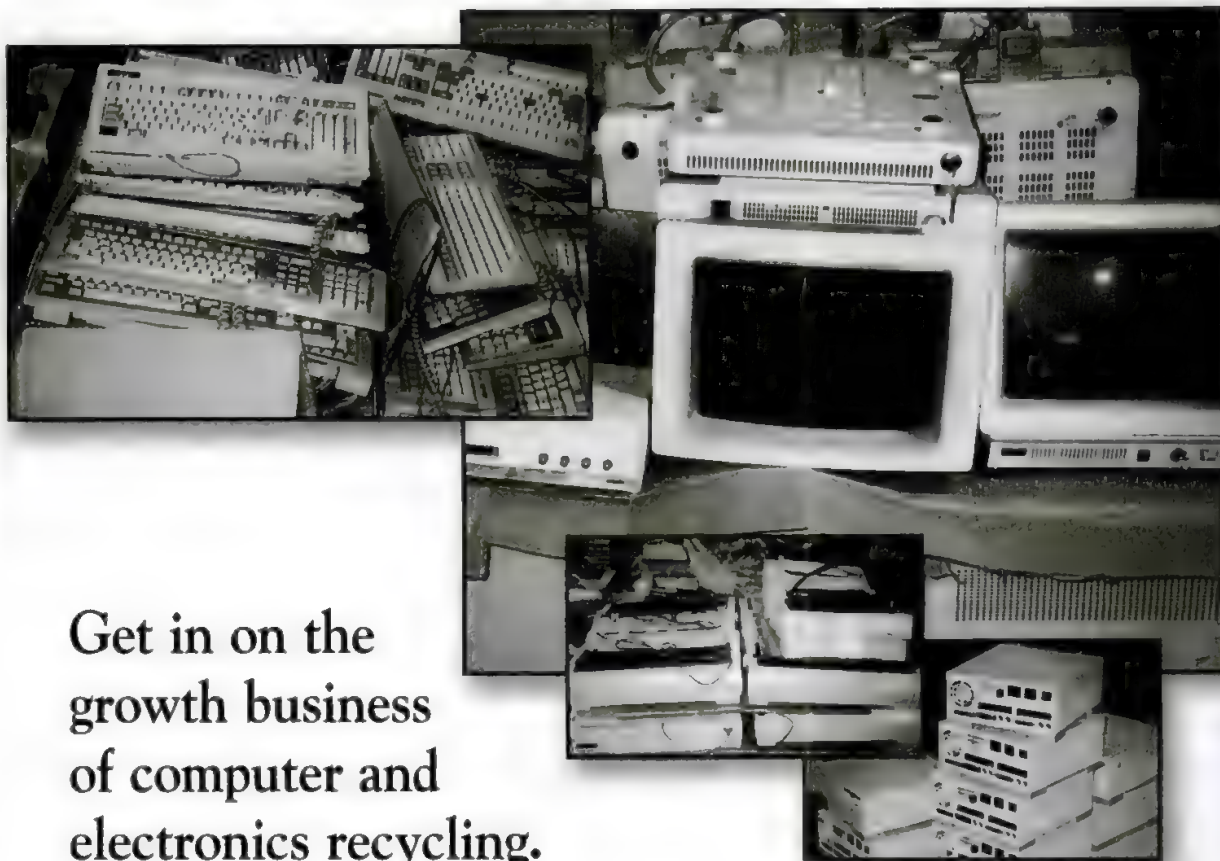
Armada 7400:

- ArmadaStation II Expansion Base: **\$879***
- Additional Li-Ion Battery: **\$189***

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- Memory - 64MB SDRAM PC-100 Compliant
- Hard Drive - Western Digital 8.4GB Ultra DMA
- Floppy Drive - Sony 3.5" 1.44MB
- Video Card - ATI XPERT@WORK 8MB AGP
- DVD-ROM - Toshiba DVD 2X EIDE with decoder software
- Modem - Diamond SupraMAX 56K V.90 PCI
- Sound Card - Creative SB Ensoniq 32-voice PCI
- Speakers - (2pc) 120 watt power
- Keyboard - NETRAM 104 key PS/2
- Mouse - NETRAM two button PS/2
- Software - Microsoft Windows 98
- Warranty - 1 Year On-Site

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NETRAM SYS2 \$1,929

- Processor Intel Pentium II 450MHz 512K Cache
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- Case Avus ATX Mid-Tower w/235 watts power supply
- Memory 64MB SDRAM PC-100 Compliant
- Hard Drive Western Digital 8.4GB Ultra DMA
- Floppy Drive Sony 3.5" 1.44MB
- Video Card Matrox G200 8MB AGP
- DVD-ROM Toshiba DVD 2X EIDE with decoder software
- Modem Diamond SupraMAX 56K V.90 PCI
- Sound Card Creative SB AWE64 Value
- Speakers (3pc) Altec Lansing ACS45 w/subwoofer
- Keyboard NETRAM 104 key PS/2
- Mouse Microsoft Intellimouse PS/2
- Software Microsoft Windows 98
- Warranty 1 Year On-Site

NETRAM SYS3 \$849

- Processor Intel Celeron 300MHz
- Motherboard Pentium II ATX Intel 440LX Chipset
- Case Avus ATX Mid-Tower w/235 watts power supply
- Memory 32MB SDRAM
- Hard Drive Western Digital 4.3GB Ultra DMA
- Floppy Drive Sony 3.5" 1.44MB
- Video Card ATI 3D Charger 4MB AGP
- DVD-ROM Sony 32X CD-ROM
- Modem Diamond SupraMAX 56K V.90 PCI
- Sound Card Creative SB Ensoniq 32-voice PCI
- Speakers (2pc) 120 watt power
- Keyboard NETRAM 104 key PS/2
- Mouse NETRAM two button PS/2
- Software Microsoft Windows 98
- Warranty 1 Year On-Site

NETRAM SYS4 \$1,049

- Processor Intel Pentium II 450MHz 512K Cache
- Motherboard Pentium II ATX Intel 440LX Chipset
- Case Avus ATX Mid-Tower w/235 watts power supply
- Memory 32MB SDRAM
- Hard Drive Western Digital 6.4GB Ultra DMA
- Floppy Drive Sony 3.5" 1.44MB
- Video Card Diamond SpeedStar 8MB AGP
- DVD-ROM Sony 32X CD-ROM
- Modem Diamond SupraMAX 56K V.90 PCI
- Sound Card Diamond Sonic 64bit
- Speakers (2pc) 120 watt power
- Keyboard NETRAM 104 key PS/2
- Mouse NETRAM two button PS/2
- Software Microsoft Windows 98
- Warranty 1 Year On-Site

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3COM 905TX 10/100 10BT NIC PCI	\$59
3COM 900XL 10 NIC Combo PCI	\$69

Upgrade To:

10mega Internal Zip Drive	\$89
64MB SDRAM	\$49
Toshiba DVD 2X EIDE w/decoder software	\$69
3COM 905TX 10/100 10BT NIC PCI	\$59
3COM 900XL 10 NIC Combo PCI	\$69

Upgrade To:

10mega Internal Zip Drive	\$89
64MB SDRAM	\$49
Toshiba DVD 2X EIDE w/decoder software	\$69
3COM 905TX 10/100 10BT NIC PCI	\$59
3COM 900XL 10 NIC Combo PCI	\$69



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#30982	490XCDT	PII266MMX*	32	4GB	20X	13.3" TFT	56K	\$2,649

Tecra Series

#34763	8000	PII233MMX*	32	4GB	24X	12.1" TFT	56K	\$2,749
#34767	8000T	PII266MMX*	64	6GB	24X	13.3" TFT	56K	\$3,449
#30978	780CDM	PII266MMX*	64	5.1GB	20X	13.3" TFT	56K	\$3,099
#30976	780DVD	PII233MMX*	64	5.1GB DVD	13.3" TFT	56K	\$3,099	

Portege 7000 Series

#34810	7000CT	PII266MMX*	32	4.3GB	—	12.1" TFT	56K	\$2,329
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Satellite Series

#34755	4000CDS	PII233MMX*	64	4.1GB	24X	12.1" DSTN	56K	\$1,649
#34758	4000CDT	PII233MMX*	64	4.1GB	24X	12.1" TFT	56K	\$1,949

*Pentium® processor with MMX™ technology. †Windows 98



VisionBook Plus

- 266MHz Pentium® processor w/MMX™ technology 32MB RAM
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#32719	Pro 6390	266MMX	32	3.2GB	24X	12.1" TFT	56K	\$2,199
#31862	Pro 7630	PII233*	32	3.2GB	24X	12.1" TFT	56K	\$2,399
#31866	Pro 7755	PII266*	64	4.0GB	24X	13.3" TFT	56K	\$3,199

*Pentium® II processor with MMX™ technology.

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#36312	Celeron 333MHz*	64	6.4GB	32X	TD	Win95	\$1,299
#36296	PII 350MHz MMX*	64	4.3GB	—	TD	Win95	\$1,309
#36314	PII 400MHz MMX*	64	10.0GB	32X	TD	Win95	\$1,799
#36315	PII 450MHz MMX*	64	10.0GB	32X	TD	Win95	\$1,919
#31806	PII 300MHz MMX*	32	3.2GB	24X	TD	Win95	\$1,149

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#36285	Celeron 300MHz*	32	3.2GB	—	DT	Win95	\$1,119
#36286	Celeron 300MHz*	32	3.2GB	32X	MT	Win95	\$1,249
#36288	Celeron 333MHz*	32	3.2GB	—	DT	Win95	\$1,169
#36289	Celeron 333MHz*	32	6.4GB	32X	MT	Win95	\$1,389
#36292	PII 400MHz MMX*	32	6.4GB	—	DT	Win95	\$1,599

*Pentium® II processor with MMX™ technology. †Celeron® processor w/MMX™ technology.

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- 12.1" TFT display

Order#	Model	Pentium® processor*	RAM	HD	CD	Display	Modem	Price
#35175	TP380X	PII233MMX*	32	4.6GB	24X	12.1" HPA	—	\$2,479
#35180	TP380X	PII300MMX*	32	4.6GB	24X	12.1" HPA	—	\$3,049
#35181	TP380X	PII300MMX*	32	4.6GB	24X	12.1" HPA	—	\$3,139

ThinkPad 560

#11247	TP560X	PII300MMX*	32	4GB	—	12.1" TFT	—	\$2,189
#35329	TP560X	PII233MMX*	32	4GB	—	12.1" TFT	56K	\$2,689
#35336	TP560X	PII300MMX*	64	4.6GB	—	12.1" TFT	56K	\$3,619
#35343	TP560X	PII300MMX*	64	4.6GB	—	12.1" TFT	56K	\$3,709

NEW ThinkPad 600

#30322	TP600	PII233MMX*	32	3.2GB	10-24X	13.3" TFT	56K	\$3,329
#30323	TP600	PII266MMX*	32	4.0GB	10-24X	13.3" TFT	56K	\$3,799
#30332	TP600	PII266MMX*	32	3.2GB	24X	12.1" TFT	56K	\$3,049
#35187	TP600	PII266MMX*	64	5.1GB	24X	13.3" TFT	56K	\$4,139
#35193	TP600	PII266MMX*	64	5.0GB	DVD	13.3" TFT	56K	\$4,399

ThinkPad 770

#30325	TP770E	PII266MMX*	32	5.1GB	—	14.1" TFT	33.6K	\$3,759
#30327	TP770E	PII266MMX*	64	8.1GB	DVD	14.1" TFT	56K	\$5,079

*Windows 98 †Windows NT

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- 20X CD-ROM drive 12.1" HPA
- 56K fax/data modem Win 98

#35828	C340	PII233MMX*	32	3.2GB	20X	12.1" HPA	56K	W98	\$1,499
#35833	C350	PII266MMX*	32	4.0GB	20X	13.0" HPA	56K	W98	\$1,799
#36034	E350	PII266MMX*	32	3.2GB	24X	12.1" TFT	56K	W95	\$1,999
#36036	E355	PII233MMX*	32	3.2GB	24X	13.3" TFT	56K	W95	\$2,399
#36038	E340	PII266MMX*	32	3.2GB	24X	13.3" TFT	56K	W95	\$2,799
#36044	E350	PII300MMX*	32	5.0GB	24X	13.3" TFT	56K	W95	\$3,299

*Pentium® II processor with MMX™ technology

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#26786	15620MT	233MHz MMX*	32	3.1GB	20X	12.1" TFT	56K	\$1,979

Armada 1700 Series

#33230	1700	PII 233MHz MMX*	32	4.0GB	24X	12.1" TFT	56K	\$2,479
#33235	1700	PII 266MHz MMX*	32	4.0GB	24X	13.3" TFT	56K	\$2,979
#35391	1700	PII 300MHz MMX*	32	5.0GB	24X	14.1" TFT	56K	\$3,799

New Armada 7800 Series

#31072	7800	PII 266MHz MMX*	64	5.0GB	20X	13.3" TFT	33.6K	\$4,299
#31073	7800	PII 266MHz MMX*	64	5.0GB	20X	13.3" TFT	—	\$4,099

Armada 3500 Series

#35380	3500	PII 266MHz MMX*	32	4.1GB	—	12.1" TFT	—	\$3,229
#35381	3500	PII 300MHz MMX*	64	6.4GB	—	13.3" TFT	—	\$4,199

Armada 6500 Series

#35483	6500	PII 300MHz MMX*	64	8.4GB	24X	14.1" TFT	56K	\$4,899
#35485	6500	PII 300MHz MMX*	64	8.4GB	24X	14.1" TFT	56K	\$4,999

*Integrated 56K w/10/100 Ethernet †Windows NT

COMPAQ



Presario 1220

- 200MHz Media GX enhanced processor w/MMX™ technology 16MB RAM
- 2.1GB HD 56Kbps Modem 20X CD-ROM
- 12.1" HPA Display Factory refurbished

Order#	Model	Pentium® processor*	RAM	HD	CD	Display	Modem	Price
#36011	1235	266MHz AMD-K6	32	4.0GB	24X	12.1" HPA	56K	\$1,799
#36007	1240	266MHz AMD-K6	64	4.0GB	24X	12.1" TFT	56K	\$2,099
#32556	1650	PII 266MHz	64	4.0GB	24X	12.1" TFT	56K	\$2,599
#32563	1655	PII 266MHz	64	4.0GB	24X	13.3" TFT	56K	\$2,799
#36014	1810	PII 300MHz	64	6.4GB	DVD-2	13.3" TFT	56K	\$3,599

*Pentium® II processor with MMX™ technology

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#36601	627522U	Celeron 300	32MB	3.2GB	—	\$1,099
#36604	627525U	Celeron 300	32MB	3.2GB	32X	\$1,199
#36607	628513U	Celeron 300	32MB	3.2GB	—	\$1,299
#36598	627557U	PII350	32MB	3.2GB	—	\$1,399
#36612	627575U	PII350	64MB	6.4GB	32X	\$2,099
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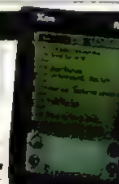
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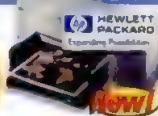
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*Purchases select HP printers with 1500 PC and Display and get a \$50 mail-in rebate. Qualifying products include: DeskJet 4840, 712C, 722C, 850Cse, OfficeJet 600, 650, 700 Series. Limit one per household. Valid 10/20/99 - 1/31/00. Ask for coupon #27134

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350/Pii 64MB 10GB 32X	1617.02
400/Pii 64MB 10GB 32X	1759.64
450/Pii 64MB 10GB 32X	1869.34
Deskpro EP Series Small Business Solutions	
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350/Pii 64MB 6.4GB 24X	1559.83
400/Pii 64MB 6.4GB 24X	1696.81
Deskpro EN Series desktops	
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300 Celeron 32MB 3.2GB 10/100	1175.53
333 Celeron 32MB 3.2GB 10/100	1219.87
333 Celeron 32MB 3.2GB	1138.30
333/Pii 32MB 4.3GB 10/100	1936.17
350/Pii 32MB 6.4GB 24X	1574.47
350/Pii 64MB 10GB 10/100	1749.85
400/Pii 32MB 6.4GB	1549.19
400/Pii 64MB 6.4GB 24X 10/100	1889.62
400/Pii 64MB 4.3GB 24X 10/100	2198.45
450/Pii 64MB 10GB 10/100	2098.70
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333 Celeron 32MB 6.4GB 32X	1369.34
333 Celeron 32MB	
6.4GB 32X 10/100	1457.45
333/Pii 32MB 6.4GB 24X 10/100	1559.83
350/Pii 32MB 6.4GB 24X 10/100	1699.13
350/Pii 64MB 4.3GB 24X 10/100	2085.11
400/Pii 64MB 9.1GB 24X 10/100	2484.04
450/Pii 64MB 6.4GB 32X 10/100	2026.60
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32X 10/100 NT	1798.92
350/Pii 32MB 4.2GB	
10/100 Win 98	1489.21
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32X 10/100 NT	1956.99
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400/Pii 64MB 6.4GB 32X NT	1761.44
PC 300PL Series mini-towers	
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32X 10/100 NT	1749.03
400/Pii 64MB 6.4GB	
32X 10/100 NT	1958.55
450/Pii 64MB 6.4GB	
32X 10/100 NT	2238.46

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◆ 32MB RAM standard	◆ 4.3GB hard drive
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333 Celeron 32MB 4.3GB 32X	1233.15
333/Pii 32MB 4.3GB 32X	1346.47
400/Pii 64MB 8GB 32X	1870.88
450/Pii 64MB 8GB 32X	1939.93
HP VE Series desktops	
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300 Celeron 32MB 3.2GB 10/100	991.66
HP VE Series mini-towers	
300 Celeron 32MB 3.2GB	947.35
300 Celeron 32MB 3.2GB 32X	1084.71
HP VL Series desktops	
333/Pii 32MB 4.3GB	1413.46
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32X 10/100	2398.72
HP VL Series mini-towers	
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◆ Integrated 56K bps (K56flex) modem	◆ Windows® 95

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TOSHIBA

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100CT 166/MMX 32MB	
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490CDT 233/MMX 32MB	
4GB 12.1" AM 20X	2317.56
330CDS 266/MMX 32MB	
4GB 12.1" DS 20X	1396.16
330CDT 266/MMX 32MB	
4GB 12.1" AM 20X	1696.39
490XCDT 266/Pii 32MB	
4GB 12.1" AM	2687.38
4000CDS 233/Pii 32MB	
4GB 12.1" DS	1579.23
4000CDT 233/Pii 32MB	
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5.1GB 13.3" AM DVD	4267.56
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4GB 12.1" AM 24X	2477.83
8000CT 266/Pii 64MB	
4GB 12.1" AM 24X	3397.56
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2.1GB 12.1" DS	1518.96
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3.2GB 12.1" AM	2020.00
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13.3" AM	
6500 300/Pii 64MB 6.4GB	4857.23
14.1" AM 24X	
6500 300/Pii 64MB 6.4GB	4957.23
14.1" AM 24X WNT	
7400 300/Pii 64MB 6.4GB	4175.12
13.3" AM 24X	
7800 266/Pii 64MB 5GB	3997.56
13.3" AM 20X	
7800 266/Pii 64MB 5GB	4257.23
13.3" AM 20X	

IBM

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13.3" AM 24X	2237.18
380Z 300/Pii 32MB 4GB	
13.3" AM 24X	2737.16
380Z 300/MMX 32MB 4GB	
13.3" AM 24X NT	2797.86
380Z 233/Pii 32MB 4GB	
13.3" AM 24X NT	2327.36
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12.1" AM	2527.14
560Z 300/Pii 64MB 6.4GB	
12.1" AM	3387.56
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13.3" AM 24X	3057.23
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13.7" AM DVD	5237.16
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7590 266/MMX 48MB 5GB	
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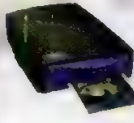
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AM = active-matrix color display DS = dual-scan color display



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300/P11 64MB 10/100 RACK **3016.30**
400/P11 64MB 16X 10/100 Ethernet **2798.91**
450/PR 64MB 16X 10/100 Ethernet **3182.85**

HP NetServer E50 servers

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300/P11 64MB 4.2GB **1976.57**
300/P11 64MB/TBU 4.2GB **2224.21**
333/P11 64MB 4.3GB **1859.35**
333/P11 64MB 4.3GB **2147.55**
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IBM

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300/P11 64MB 4.5GB 32X **2345.81**
350/P11 64MB 32X **2195.99**
350/P11 64MB 32X **2598.79**
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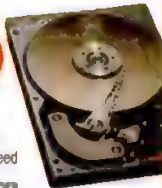
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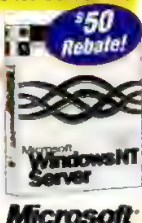
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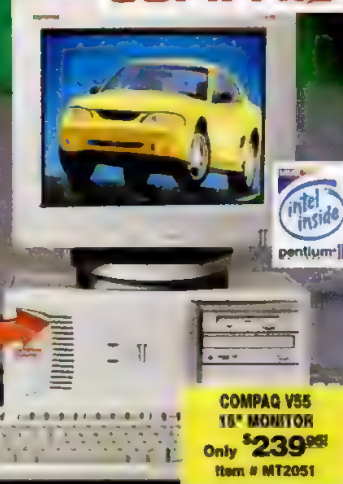
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- Includes PrecisionScan with integrated OCR, Adobe Photoshop and scanning software



LAPTOPS IBM COMPAQ TOSHIBA

CP9078 IBM Thinkpad 380Z PII/233MHz, 4.0GB, 32MB, 24X, 13.3" TFT, Win 98	\$2469.00
CP9081 IBM Thinkpad 560Z PII/300MHz, 6.4GB, 64MB, 12.1" TFT, Win 98	\$3549.00
CP9088 IBM Thinkpad 600E PII/300MHz, 6.0GB, 64MB DVD, 56K, 13.3" TFT, Win 98	\$4349.00
CP9102 IBM Thinkpad 770X PII/300MHz, 8.1GB, 64MB DVD, 14.1" TFT, NT	\$5199.00
CP8941 Satellite 4000CDT PII/233MHz, 4.0GB, 32MB, 20X, 56K, 12.1" SVGA DSTN	\$1599.00
CP8940 Satellite 4000CDT PII/233MHz, 4.0GB, 32MB, 20X, 56K, 12.1" SVGA TFT	\$1799.00
CP9260 Satellite 4010CDT PII/266MHz, 4.0GB, 32MB, 20X, 56K, 12.1" SVGA DSTN	\$1799.00
CP9261 Satellite 4010CDT PII/266MHz, 4.0GB, 32MB, 20X, 56K, 12.1" SVGA TFT	\$1999.00
CP9181 Armada 1700 PII/233MHz, 3.2GB, 32MB, 24X, 56K, 12.1" SVGA CSTN	\$1999.00
CP8217 Armada 1700 PII/266MHz, 4.0GB, 32MB, 24X, 56K, 13.3" XGA TFT	\$2799.00

DESKTOPS IBM COMPAQ HEWLETT PACKARD

CP9107 Compaq Deskpro EN Celeron/300MHz, 32MB, 3.2GB, 32X, Win 95, DT	\$1179.00
CP9100 Compaq Deskpro EN Celeron/333MHz, 32MB, 6.4GB, 32X, NIC, Win 95, MT	\$1399.00
CP9110 Compaq Deskpro EN PII/400MHz, 32MB, 6.4GB, Win 95, DT	\$1499.00
CP7765 Compaq Deskpro EN PII/350MHz, 32MB, 6.4GB, NIC, Win NT, DT	\$1499.00
CP9105 Compaq Deskpro EN PII/450MHz, 64MB, 6.4GB, 32X, NIC, Win NT, MT	\$1949.00
CP7774 Compaq Deskpro EN PII/350MHz, 32MB, 6.4GB, 24X, NIC, Win NT, MT	\$1649.00
CP7751 Compaq Deskpro EN PII/400MHz, 64MB, 9.1GB ¹ , 24X, NIC, Win NT, MT	\$2399.00
CP9096 IBM PC300PL PII/450MHz, 64MB, 6.4GB, 32X, Win NT, MT	\$1299.00
CP9090 IBM PC300GL PII/350MHz, 32MB, 3.2GB, Win 98, DT	\$1299.00
CP9093 IBM PC300GL PII/450MHz, 64MB, 6.4GB, 32X, Win NT, DT	\$1999.00
CP8965 HP Brio 7133 Celeron/300MHz, 32MB, 2.1GB, 32X, MT, Win 98	\$889.00
CP9025 HP Brio 8534, Celeron/333MHz, 32MB, 4.3GB, 32X, MT, Win 98	\$1139.00
CP8969 HP Brio 8531, PII/350MHz, 32MB, 8.0GB, 32X, Win 98	\$1399.00

¹Includes Ultra wide SCSI hard drive

SCANNERS HEWLETT PACKARD MICROTEK

IN7313 HP ScanJet 4100CSE NEW!	\$1199.95
IN6818 HP ScanJet 5100CSE	\$299.95
IN7311 HP ScanJet 6200CSE NEW!	\$399.95
IN7312 HP ScanJet 6250CSE w/25 page Auto Document Feeder NEW!	\$499.95

PRINTERS HEWLETT PACKARD LEXMARK OKIDATA

PR1297 HP LaserJet 4000SE Printer 11ppm 1200dpi	\$1149.99
PR14129 HP DeskJet 712C 6ppm blk/3ppm color NEW!	\$249.95
PR13789 Lexmark Optra K 1220 12ppm/600dpi	\$729.95
PR13601 Okidata PagePro 101, 10ppm/600dpi	\$499.95

MONITORS NEC Dataquest

MT1544 A500 15" 13.8" viewable 1280 x 1024 @ 60Hz	\$219.95
MT1546 A700 17" 15.6" viewable 1280 x 1024 @ 65Hz	\$419.95
MT1451 Dpquest Q53 15" 13.8" viewable 1280 x 1024 @ 60Hz	\$179.95
MT1580 Dpquest V95, 19", 18" viewable, 1600 x 1200 @ 76Hz	\$529.95

MODEMS 3Com U.S. Robotics Megahertz

DMD3947 US Robotics 56K Fax/modem - V.90 - Internal	\$127.99
DMD3441 US Robotics 56K Fax/modem - V.90 - External	\$147.99
DMD3443 US Robotics 56K WIN modem - V.90 \$30 REBATE	\$57.99*
DMD3598 3Com Megahertz 56K cellular capable KJack - Mac & PC	\$209.99

*Price after mt. & \$30 mail-in rebate. Price before rebate is \$87.99. Offer expires 12/31/98.

STORAGE Seagate Western Digital Quantum

DR8698 Western Digital Caviar 8.4GB EIDE Hard Drive	\$229.95
DR8124 Quantum Fireball SE 4.3GB Ultra DMA Hard Drive	\$159.95
DR8132 Quantum Vilion4 5GB SCSI Hard Drive-7, 200 RPM	\$299.95
DR8188 Seagate Barracuda 18.2GB Ultra SCSI Hard Drive	\$1199.95
DR8189 Seagate Barracuda 18.2GB Ultra Wide SCSI Hard Drive	\$1199.95

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DESKTOPS/TOWERS



AcerPower Systems

104784	300 Celeron/32MB/4.3GB/32X	\$759
102281	300A/32MB/4.3GB/32X	\$899
59713	PII333/32MB/5.1GB/24X	\$969
104483	300ACeleron/32MB/4.3GB/32X/56K/W98	
	w/15" Monitor/color scanner/color printer	\$999*
59714	PII350/32MB/5.1GB/32X	\$1099
102317	400 PII/32MB/8.4GB/32X/10/100	\$1299

COMPAQ

Compaq Desktop 6000

45006	233PII/32MB/2.1GB/24X/10/100/WinNT	\$759
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Compaq Deskpro EP & EP S85 Towerable Desktop

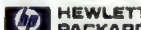
102353	300ACeleron/32MB/4.3GB	\$899
102355	333Celeron/32MB/4.3GB	\$949
102356	333Celeron/64MB/6.4GB/32X	\$1249
102357	350PII/64MB/4.3GB	\$1279
102358	350PII/64MB/10GB/32X	\$1629
102359	400PII/64MB/10GB/32X	\$1779
102360	450PII/64MB/10GB/32X	\$1899

Compaq EN Desktop

102341	300ACeleron/32MB/3.2GB	\$1099
102285	333Celeron/32MB/3.2GB/10/100	\$1229
102344	333Celeron/32MB/3.2GB/32X	\$1149
102291	350PII/64MB/10GB/10/100/WinNT	\$1749
102280	300ACeleron/32MB/3.2GB/10/100	\$1189
102347	400PII/32MB/6.4GB	\$1549
102294	450PII/64MB/10GB/10/100/WinNT	\$2129
102348	450PII/64MB/9.1GB/32X/WinNT	\$2599

Compaq EN Minitor

102343	300ACeleron/32MB/3.2GB/32X	\$1229
102346	333Celeron/32MB/6.4GB/32X	\$1379
102288	333Celeron/32MB/3.2GB/32X/10/100	\$1479
102296	450PII/64MB/6.4GB/32X/10/100/WinNT	\$2049



HEWLETT PACKARD

Hewlett-Packard Brio

102177	333Celeron/32MB/4.3GB/32X	\$899
102224	333Celeron/64MB/8.0GB/32X	\$1129
102229	333PII/32MB/4.3GB/32X/56K	\$1149
101971	350PII/32MB/6.0GB/32X	\$1199
102670	450PII/64MB/6.0GB/32X	\$1749

Hewlett-Packard Vectra

103656	350PII/32MB/3.2GB	\$1149
100959	350PII/32MB/3.2GB	\$1329
101545	350PII/64MB/6.4GB/32X/10/100	\$1679
100958	400PII/64MB/6.4GB/32X	\$1799
58873	400PII/64MB/10.1GB/32X/10/100	\$1829
101312	450PII/64MB/10.1GB/32X	\$2089



IBM PC 300 GL Desktop

59583	350PII/64MB/3.2GB	\$1319
59582	400PII/64MB/3.2GB	\$1509

IBM PC 300 GL Minitor

59580	333PII/32MB/3.2GB	\$1059
59584	350PII/64MB/6.4GB/32X	\$1559
59585	400PII/64MB/6.4GB/32X	\$1689

IBM PC 300PL Desktop

54601	350PII/64MB/6.4GB	\$1759
54602	400PII/64MB/6.4GB	\$1879

IBM PC 300PL Minitor

54606	350PII/64MB/4.2GB	\$1699
54607	400PII/64MB/6.4GB	\$1899



Inteva Minitor

104557	Cyrix III 333/32MB/4.0GB/24X/56K/Win98	\$699
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104570	Celeron 333/32MB/3.2GB/Win98	\$699
104571	333PII/32MB/4.0GB/Win98	799
104916	Cyrix III 333/32MB/3.2GB/24X/56K/Win98	799*
104573	333PII/32MB/4.0GB/32X/Win98	899
104559	K6-2/350/64MB/8.4GB/32X/56K/Win98	999
104564	333PII/64MB/6.4GB/32X/56K/Win98	999
104566	350PII/64MB/8.4GB/32X/56K/Win98	1099
104567	400PII/64MB/8.4GB/32X/56K/Win98	1299

*Includes 15" monitor.

TOSHIBA

Toshiba Equium

56244	350PII/64MB/4.0GB/32X/10/100	\$1299
56256	400PII/64MB/6.0GB/32X/10/100	\$1579

NOTEBOOKS



Acer Extensa

103763	P266/MMX/32MB/4.1GB/20X/12.1" DS	\$1499
103764	P266/MMX/32MB/4.1GB/20X/12.1" TFT	\$1699
57894	233PII/32MB/2.1GB/24X/56K/12.1" DS	\$1399

COMPAQ

Compaq Armada 1700 Series

103055	233PII/32MB/3.2GB/24X/56K/12.1" HPA	\$1599
58895	233PII/32MB/4GB/24X/56K/12.1" TFT	\$2299
103054	300PII/32MB/5GB/24X/56K/14.1" TFT	\$3499

Compaq Armada 3500 Series

103057	266PII/32MB/4.1GB/12.1" TFT	\$3189
103058	300PII/64MB/6.4GB/13.3" TFT	\$4189

Compaq Armada 7000 Series

102985	300PII/64MB/6.4GB/24X/13.3" TFT	\$3899
102989	300PII/64MB/6.4GB/24X/33.6GB/13.3" TFT	\$4095
55276	266PII/64MB/5GB/20X/13.3" TFT	\$3995
102995	300PII/64MB/8GB/DVD/33.6GB/14.1" TFT	\$3399

Compaq Presario

102462	266AMD-K6/32MB/4GB/24X/56K/12.1" HPA	\$1899*
102463	266MMX/64MB/4GB/24X/56K/12.1" TFT	\$1999*
102464	300PII/64MB/6.4GB/24X/56K/12.1" TFT	\$2399*
58296	266PII/64MB/4GB/24X/56K/13.3" TFT	\$2799
101785	300PII/64MB/6.4GB/DVD/56K/13.3" TFT	\$3499*

*After mfr rebate.



Fujitsu LifeBook

102061	233PII/32MB/3.2GB/20X/56K/12.1" HPA	\$1299
102054	266PII/32MB/4GB/20X/56K/13.3" HPA	\$1599
102055	233PII/32MB/3.2GB/24X/56K/12.1" TFT	\$1799
102056	233PII/32MB/3.2GB/24X/56K/13.3" TFT	\$2199
102059	266PII/32MB/4GB/24X/56K/13.3" TFT	\$2599
102061	300PII/32MB/5GB/24X/56K/13.3" TFT	\$2899

HITACHI

Hitachi VisionBook

58876	233PII/32MB/3.2GB/24X/56K/LAN/12.1" TFT	\$1799
102035	266PII/32MB/4GB/24X/56K/LAN/12.1" TFT	\$2099
100119	266PII/64MB/4GB/24X/56K/LAN/13.3" TFT	\$2799
102033	300PII/64MB/6.4GB/24X/56K/LAN/13.3" TFT	\$3099



IBM ThinkPad 380

101505	233PII/32MB/4GB/24X/13.3" TFT	\$2159
103300	233PII/32MB/4GB/13.3" TFT	\$2279
101506	300PII/32MB/4GB/24X/13.3" TFT	\$2599

IBM ThinkPad 560

101503	233PII/32MB/4GB/56K/12.1" TFT	\$2459
101594	300PII/64MB/6.4GB/56K/12.1" TFT	\$3259
101595	300PII/64MB/6.4GB/56K/12.1" TFT	\$3399

IBM ThinkPad 600

54589	233PII/32MB/3.2GB/24X/56K/13.3" TFT	\$2949
100860	233PII/32MB/3.2GB/24X/56K/12.1" TFT	\$2999
54590	266PII/32MB/4GB/24X/56K/13.3" TFT	\$3299
101589	300PII/64MB/5.1GB/24X/56K	\$3959
101590	300PII/64MB/5.1GB/DPE	\$4059

IBM ThinkPad 770

101581	300PII/128MB/8.1GB/56K	\$4999
54596	266PII/32MB/5.1GB/14.1" TFT	\$3459
54597	266PII/64MB/8.1GB/56K/14.1" TFT	\$4499
101582	300PII/128MB/8.1GB/56K/WinNT	\$4999

SHARP

Sharp Actius UltraLite

59797	233MMX/64MB/3.2GB/56K/11.3" TFT/3lbs	\$1999
103002	266MMX/64MB/4.3GB/56K/11.3" TFT/3lbs	\$2299

TOSHIBA

Toshiba Satellite

101103	233PII/32MB/4.1GB/24X/56K/12.1" DS	\$1579
101104	233PII/32MB/4.1GB/24X/56K/12.1" TFT	\$1779

103394	266PII/32MB/4.1GB/24X/56K/12.1" TFT	\$1999
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Toshiba Portégé

101101	266PII/32MB/4.3GB/56K/12.1" TFT	\$2899
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102877	300PII/32MB/4.3GB/56K/12.1" TFT	\$3359
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Toshiba Tecra

101320	233PII/64MB/6.4GB/24X/56K/12.1" TFT	\$2499
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101323	266PII/64MB/6.4GB/24X/56K/13.3" TFT	\$3499
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102883	300PII/64MB/6.4GB/24X/56K/13.3" TFT	\$3645
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102882	300PII/64MB/8.1GB/24X/56K/14.1" TFT	\$4215
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HANDHELD PCs

3Com

39153	PalmPilot Professional Edition 1MB	\$229.95
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54104	Palm III 2MB, Backlit, Infrared Port	\$49.95
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Beepwear

51803	Pager Watch (Ridge Face)	\$99
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57121	Pager Watch (Five Point Face)	\$99
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Casio

104882	Cassiopa E-11	\$795
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Compaq

50627	C-Series 2015c	\$799
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Cross

52245	CrossPad "After \$50 rebate"	\$349.95
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102534	CrossPad XP 6" x 9"	\$99
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Franklin Electronics

101561	RDX Pro 5 for Laptops	\$189.95
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101562	RDX Pro 5-DS for Desktops	\$229.95
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Hewlett-Packard

49558	620UX Color Palmtop PC	\$699
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58973	660UX Color Palmtop PC	\$899
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Philips

55577	Nino 301 4MB w/Dock and Battery	\$349.95*
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58083	Nino 312 8MB w/Dock, Batt., Modem, Coupon	\$399.95*
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51843	Velo 500 16MB w/Dock	\$499.95*
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51844	Velo 500 24MB w/Dock	\$599.95*
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Psion

42282	Series 5 Palmtop 8MB	\$489.95
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Sharp

48466	Mobilion HC-4500	\$649.95
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56197	Mobilion HC-4600 16MB	\$699.95
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55800	Mobilion HC-4100 (Refurbished)	\$479.95
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48469	Digital Camera Card for Mobilion	\$379
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MONITORS

Daewoo Electronics

101846	15" 51BK	\$119
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103044	17" 7108	\$219
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EZC International

48282	15" EZ-V15000	\$150
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48293	17" EZ-P17000	\$249
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Hitachi

43328	19" Elite 751	\$699
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39604	21" SuperScan Pro 800	\$699
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Iiyama

102655	17" VisionMaster 400	\$449
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SCANNERS

Fujitsu	
52943 ScanPartner 600C SCSI Flatbed w/ADF	\$1399
Hewlett-Packard	
101191 ScanJet 4100 Cse	\$199
40509 ScanJet 5100 Cse	\$299
101053 ScanJet 6200 Cse	\$399
Memorex	
54936 SCF 6120P Flatbed	\$99.95
54937 SCF 9360P 30 Flatbed	\$79.95
Microtek	
50485 ScanMaker V310	\$49.95*
57799 ScanMaker X6EL	\$29.95*
101546 ScanMaker 4	\$69
Minolta	
40612 Dimage Scan Dual Film Scanner	\$599
Nikon	
58677 Super CoolScan 2000	\$1799
Polaroid	
31234 SprintScan 35 Plus	\$1399
UMAX	
48248 Astra 610S Cross-Platform SCSI Flatbed	\$99.95*
101653 Astra 1220U	\$129*
54475 Astra 1220S Cross-Platform	\$149*
40605 Astra 1200S	\$179*
51167 PowerLook II Duo/Photoshop LE	\$89*
Viewsonic	
58577 PaperPort 31008	\$49.99*
52960 PaperPort 60008	\$9.99
40455 PaperPort Strobe Pro	\$149.99*
53044 PaperPort OneTouch Flatbed	\$169*

DIGITAL CAMERAS

Canon	
57727 PowerShot A5 Digital Camera	\$699
57435 ZR MiniDV Camcorder	\$95
101574 Vistara MiniDV Camcorder	\$146
57434 Optura MiniDV Digital Camcorder	\$176
Kodak	
58857 DC220	\$699
58866 DC260	\$899
Nikon	
104285 Coolpix 900	\$149
58674 Coolpix 600	\$79
Olympus	
53672 D-340L	\$499
104348 D-900 Zoom	\$799
47234 D-600L	\$899
104349 D-620L	\$1199
SONY	
59952 Mavica FD51	\$499
59953 Mavica FD71	\$699
103305 NEW! Mavica FD81	\$799
Toshiba	
100907 POR-M1	\$595

PROJECTORS

Epson	
53777 PowerLite 5000XB LCD Projector	\$4999
InFocus	
101433 LP425 LCD Projector	\$4599
101445 LP735 LCD Projector	\$6999
Polaroid	
52858 Polaview 211E LCD Projector	\$3999
49917 Polaview 215 LCD Projector	\$3999

INPUT DEVICES

Adesso	
21345 TriForm Extended Keyboard PC	\$44.95
54449 Eagle Touch Keyboard PS/2	\$2.95
54461 Powermouse Ergonomic PS/2	\$14.95
30219 NuForm Keyboard w/TouchPad PC	\$44.95
30217 NuForm Keyboard PC	\$29.95
Belkin	
58806 USB 3 Button Mouse	\$19.95
58304 USB 104 Key Keyboard	\$9.95
49333 USB Express Hub	\$109.95
Cross Pen	
52244 iPen Pro	\$134.95
Good Systems Inc.	
101526 TelevisorT3 Pro PC TV Converter	\$329.95
35455 Optical Laser PS/2 Mouse	\$29.95

Kensington Technology Group

25095 Expert Mouse	\$99.95
57085 Mouse in a Box Scroll PC	\$24.95
39535 Orbit Trackball PC	\$49.95

Keytronic Corporation

39590 104 Keyboard PS2	\$24.95
48987 Keytronic Classic Keyboard	\$29.95
57089 Lifetime Mouse PS/2	\$9.95

Logitech Inc.

102951 Cordless Desktop Keyboard and Mouse	\$99.95
49720 Trackman Marble FX	\$79.95
54277 Trackman Marble Plus	\$99.95

45944 MouseMan+	\$49.95
45949 MouseMan	\$39.95
45943 First Mouse PS/2	\$16.95

Marlow Data Systems

32761 105 Keyboard	\$29.95
21451 2-Button Ergonomic Serial Mouse	\$14.95
21458 2-Button Trackball	\$24.95

Wacom

101572 Intuos G18	\$209.95
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MULTIMEDIA

Creative Labs

100196 Sound Blaster LIVE!	\$199.95
100142 Sound Blaster 128 Plus 4-Pc. Speakers	\$149.95
53742 Blaster 32X CD-ROM Drive	\$69.95
53743 Blaster DVD ROM Drive	\$99.95*
45690 PC DVD Encore Dn2	\$199.95*
53395 3D Blaster Voodoo 2 12MB PCI	\$189.95*

DATA STORAGE

Hewlett Packard

100153 Surestore 8110i CD-Writer Plus Ext.	\$399
101297 CD-R Media (50 Pack)	\$9.95
48133 5GB Colorado Int. Tape Drive w/Tape	\$199
48173 5GB Colorado Ext. Tape Drive w/Tape	\$249
49969 24GB Surestore Dat 24i DQS-3 Int.	\$1999

Iomega

102641 Zip Drive Parallel Ext.	\$119.95
102640 Zip Drive SCSI Ext.	\$119.95
46089 Zip Drive SCSI Int. w/Zip Zoom	\$119.95
46090 Zip Drive ATAPI Insider	\$99.95
44705 Zip Plus	\$169.95
103333 Zip Disk 10-Pack (Gray)	\$9.95
49269 Jaz Drive 1GB SCSI Ext. (Refurbished)	\$199.95
23616 Jaz 1GB SCSI Ext.	\$299.95
102878 Jaz 2GB SCSI Ext.	\$349.95
24202 Jaz 1GB Disk Single	\$99.95
32556 Jaz 1GB Disk 3-Pack	\$269.95
47079 Jaz 2GB Disk 3-Pack	\$299.95

Kodak

101849 CDR Media-30	\$59.95
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Memorex

52486 CDR 74mm 10-Pack w/120 Mail-in Rebate	\$27.95
39820 CDR 74mm 100-Pack	\$149.95
48589 CDR-RW Disc 5-Pack w/5 FREE CDR Discs	\$49.95

Meridian Data

102404 8GB Snap! Server	\$949.95
102405 16GB Snap! Server	\$1099.95

Quantum

48043 DLT IV 35/70GB Tape Cartridge	\$84.95
58581 5.1GB Fireball II Ultra DMA HD	\$159
50869 4.3GB Fireball SE Ultra SCSI HD	\$289
50868 6.4GB Fireball SE Ultra SCSI HD	\$369
50867 8.4GB Fireball SE Ultra SCSI HD	\$489

Seagate

49829 2.1GB Medialist IDE HD	\$115
46190 3.2GB Medialist IDE HD	\$119
51478 4.3GB Medialist Ultra ATA HD	\$139
51475 6.5GB Medialist Ultra ATA HD	\$169
50294 8GB TapeStar Int. SCSI Travan Tape Drive	\$219
54435 9 1GB Medialist Pro Ultra ATA HD	\$269
54431 9 1GB Barracuda 9LP SCSI	\$629
55963 9 1GB Cheetah Ultra2 LVD HD	\$769
55919 18.2GB Barracuda Ultra Wide SCSI HD	\$1119
56824 4.5GB Cheetah Ultra2/LVD HD	\$399

Smart and Friendly

53487 4x12 CD Speedwriter SCSI Int.	\$399
53408 4x12 CD Speedwriter SCSI Ext.	\$499
50181 4x26 CD-RW 426 SCSI Ext.	\$999

Syquest

47250 SparQ 1GB Ext. Parallel Drive	\$199
47251 SparQ 1GB Int. EIDE Drive	\$199
102638 SparQ Cartridge Bonus Pack	\$179.95
48040 SyJet 1.5GB Ext. SCSI Drive	\$299
48946 SyJet 1.5GB Cartridge 3-Pack	\$199.95

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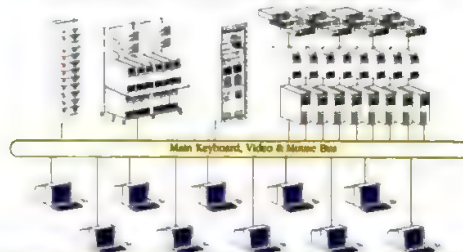
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74P Budget	4X \$24-\$21	\$55-\$52	\$109-\$99	\$179-\$169
Platinum	8X \$23-\$21	\$51-\$48	\$117-\$113	\$199-\$189
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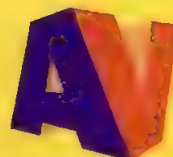
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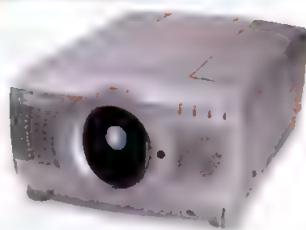
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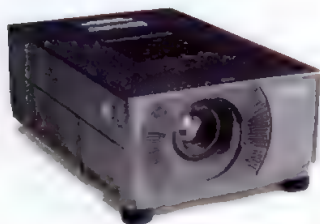


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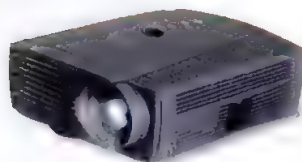


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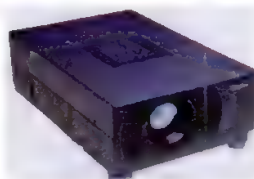
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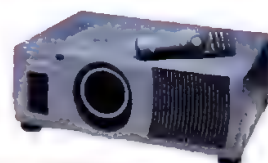


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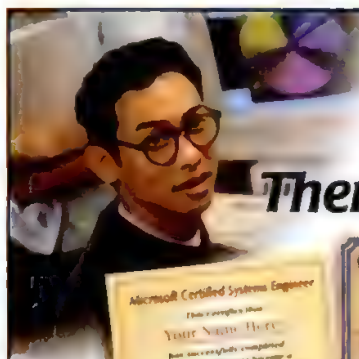
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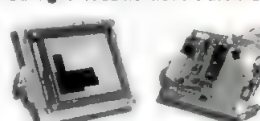
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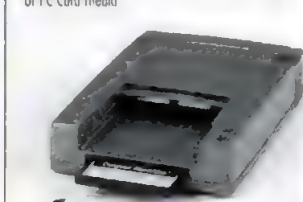
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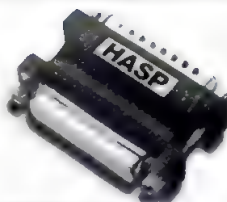
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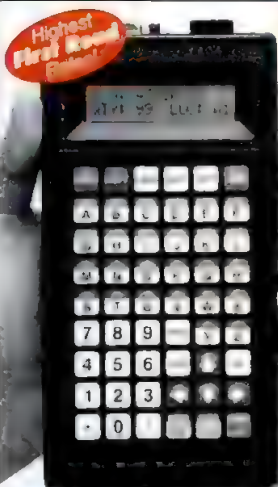
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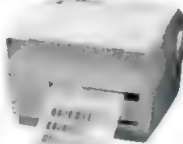


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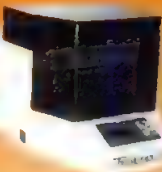
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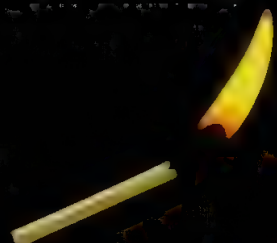
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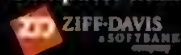
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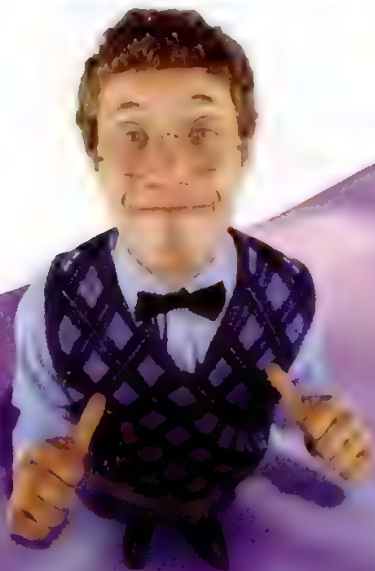
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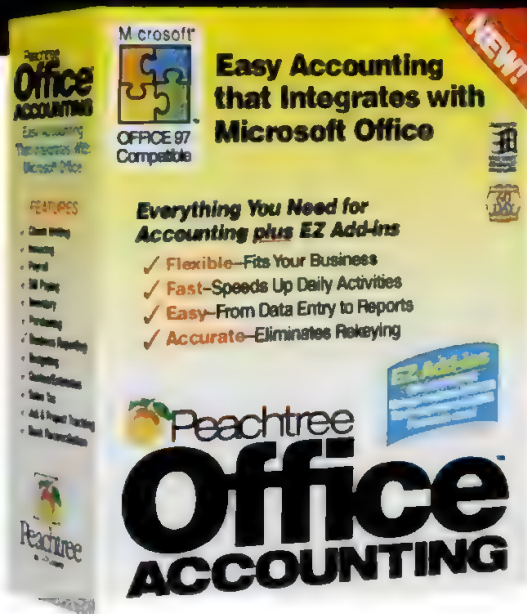
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The GIFT of GIVING

Fifty products for your holiday wish list. From games to gadgets, here's a glimpse of this year's best gift ideas.

By Jennifer Triverio



estive wrapping paper, carolers, decorated homes and storefronts—these are but a few of the pleasures of the holiday season. Finding the perfect gift for that hard-to-please relative, on the other hand, is one of the season's frustrations (we won't even discuss trying to find parking at the mall). It's our intent in *PC Magazine's* fifth annual gift guide to serve up a bounty of gift-giving suggestions.

For this roundup, we wanted to concentrate on the newest arrivals—products scheduled to hit store shelves in November and December—so we looked at dozens of prerelease (beta) programs in addition to products that were released earlier. Though the manufacturers of the newer titles have assured us that they will indeed ship on time, some may be delayed and therefore unavailable for several more weeks or months.

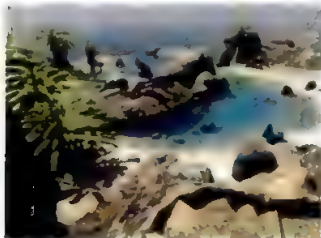
The products in this story are divided into four categories: Games, Kids' Software, Gadgets & Hardware, and Home & Reference. We also highlight a handful of DVD-ROM titles in the following pages for those of you who have upgraded to DVD drives. We're hopeful that among the products you'll find many gifts worth giving to your favorite PC users.

Still stuck for a few gift ideas, even after perusing our guide? You may also want to consider the 100 CD-ROM titles in our "Ultimate Software Library" story from a few months back (October 6, 1998). Find it online at www.pcmag.com. Above all, remember: It's the thought that counts.



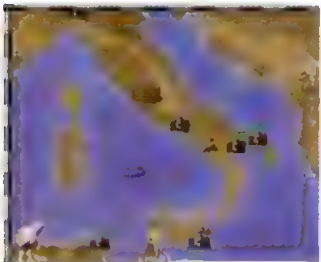
GAMES

Ages of Myst (\$49.95 list; Red Orb Entertainment, 800-567-2610, www.redorb.com). Do you believe it's been five years since the debut of *Myst*? To mark the occasion, Red Orb has released a commemorative edition that bundles *Myst* and its



sequel *Riven*. Available only through the holidays, *Ages of Myst* is packaged in a wonderfully detailed foil-covered box and contains both titles, a hardcover personal journal for your notes, and *The Making of Riven* CD-ROM, which provides a behind-the-scenes look at the epic adventure game. Though *Ages of Myst* contains the CD-ROM version, *Riven* is also available on DVD-ROM.

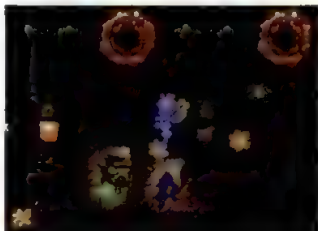
Caesar III (\$49.95 list; Sierra Inc., 800-757-7707, www.sierrastudios.com). If you've ever dreamed of donning a toga and joining the ranks of the Roman Empire, *Caesar III* is



worthy of your consideration. As a city manager, you must build, rule, maintain, and defend your Roman city (much as you would in *SimCity*). You've got to take care of your properties, your people, and of course the five gods: An unhappy population and irate gods will get you absolutely nowhere in this game. Play your cards right, and you'll be sitting pretty in an opulent city of yesteryear.

Dune 2000 (\$39.95 list; Westwood Studios, 888-212-1702, www.westwood.com). The long-awaited sequel to *Dune II* retains all the addictive real-time strategy game play of its predecessor and adds Internet and LAN multiplayer options, revved up graphics, and a sleeker interface. It also includes new video mission briefings that outline your expedition. Playing as the leader of House Atreides, House Harkonnen, or House Ordos, you must use your military expertise to harvest the most spice (the most precious commodity in the land) and take control of *Dune*.

Get Medieval (\$39.99 list; Monolith Productions Inc., 800-241-4263, www.lith.com). Fans of the cult-classic game *Gauntlet* take note:



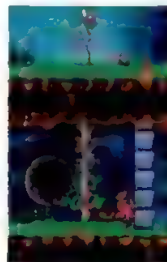
Get Medieval offers an updated twist on arcade-style action gaming. You play as one of four characters (each with a wicked sense of humor and diverse strengths and weaknesses) trying to defeat the evil dragon Daramil. To win, you must fight through 20 breeds of monsters (from trolls to ogres), 8 deadly bosses, and 40 levels of game play. Four people can play cooperatively on one PC or you can battle via the Internet or LAN.

Israeli Air Force (\$50 street; Jane's Combat Simulations/Electronic Arts, 800-245-4525, www.janes.ea.com). Jane's Combat Simulations is known for top-notch flight simulations (*F-15* was among our top 100 CD-ROMs of the year), and *Israeli Air Force* is no exception. Developed by actual



Israeli fighter pilots, IAF simulates the seven types of jets in their air force. You'll be thrilled with the 3-D rendering of both the planes and the terrain as you battle in six campaigns—three historical and three hypothetical—with a total of 42 missions. Internet and LAN multiplayer options include head-to-head battles, cooperative missions, and team play.

Jazz Jackrabbit 2 (\$29.95 list; Epic MegaGames/Gathering of Developers, 877-463-4263, www.godgames.com). *Jazz Jackrabbit 2* offers something that's been missing from PC gaming for a while: an engaging, action-packed, side-scrolling, arcade-style game. And it's funny too. The sequel to the 1994 shareware title, *Jazz 2* continues the misadventures of the zany green rabbit as he tries to thwart the evil turtle Devan Shell's attempts to wreak havoc on Jazz's world. Dozens of levels, 12 weapons, multiplayer options, and a great level-editor ensure that you won't soon tire of Jazz, his brother Spaz, or their wacky world.



The Journeyman Project 3: Legacy of Time on DVD-ROM (\$39.95 list; Red Orb Entertainment, 800-567-2610, www.redorb.com). The *Journeyman Project 3: Legacy of Time* itself isn't brand new; it debuted earlier this



year but has just migrated to DVD-ROM (which means no more having to swap the game's four disks). The adventure unfolds as you assume the identity of heroic Gage Blackwood, Agent 5 of the Temporal Security Agency, and journey back in time to explore three fabled cities: Atlantis, El Dorado, and Shangri-La. Arthur, your loyal guide, provides assistance as you explore the beautifully rendered 360-degree panoramic environments in search of objects needed to save time itself.

Knights and Merchants (\$39.95 list; Interactive Magic, 800-789-1534, www.imagicgames.com). The Middle



Ages is the setting for this real-time strategy game, in which you are the only remaining captain of the war-torn Royal Palace Guard. After the king retreats into hiding, it's your responsibility to rebuild the once-mighty empire—province by province, castle by castle, and farm by farm. The amazingly detailed maps lead to immersive game play as you undertake the 20 single-player missions and manage ten different types of troops, including knights, archers, and scouts. There are also ten multiplayer maps.

Madden NFL 99 (\$49.95 list; EA Sports, 800-245-4525, www.easports.com).

With input from former Super Bowl-winning coach John Madden and Hall of Fame-bound running back Barry Sanders, this game has got the moves. The graphics are incredible, with every stadium rendered in 3-D. This year's version features a new





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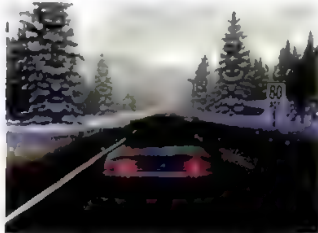
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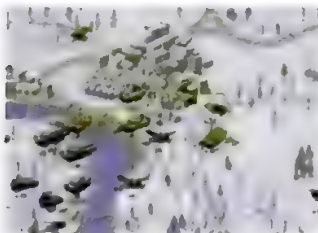
one-button interface—to get inexperienced players into the game quickly—in addition to the regular play mode. You can play against (or for) any of the current 30 NFL teams or choose from more than 100 past rosters. Also new are the Franchise mode, the Play Editor, and the Custom Playbook. Internet play is also supported, so you can choose to play at home or on the road.

Need for Speed III: Hot Pursuit (\$49.95 list; Electronic Arts, 800-245-4525, www.ea.com). The latest version of a highly touted racing franchise, *Need for Speed III: Hot Pursuit* gives you the option to play the law—or run from it. There are 13 exotic speedsters in this game, including the Ferrari 355F1 Spider and the Aston Martin DB7. Should you choose to be a police officer, you'll drive pursuit versions of the Chevrolet



Corvette or the Lamborghini Diablo SV. Eight incredibly well-rendered tracks offer nighttime and bad-weather conditions. There are also multiplayer and varying skill options.

People's General (\$49.95 list, Strategic Simulations Inc./Mindscape Inc.,



800-716-8503, www.peoplesgeneral.com). Utterly absorbing battlefield simulations are SSI's specialty, and *People's General* lives up to the company's reputation. The game is set in 2005, when Taiwan's political movements have infuriated mainland

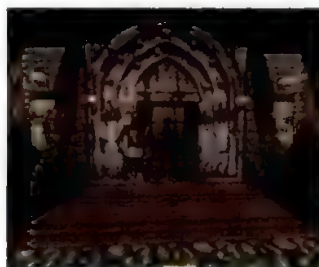
China to the point of war. In turn, 19 other nations join the hostilities, which quickly escalate to a world war. You fight with tanks, attack helicopters, and surface-to-air missiles as either the Chinese or the Western Alliance forces in two campaigns, totaling 36 scenarios. Play alone or via the Web.

RedJack: Revenge of the Brethren (\$39.95 list; THQ Inc., 818-225-5167, www.thq.com). In this swashbuckling adventure game, you play 17-year-old



Nicholas Dove from Lizard Point Island. You are on a quest to find a treasure of gold and riches that was hidden 17 years ago by the dread pirate RedJack. To claim the treasure, you must travel through the West Indies, solving puzzles and battling assassins, ghosts, and pirates. Your success depends on your wit and ability to master your weapons.

Thief: The Dark Project (\$49.95, list; Looking Glass Studios, 617-441-6333, www.lglass.com). Think you have the skills (and the nerve) to be a master



thief? You play Garrett, a cynical thief who victimizes the city's rich and corrupt. When you're offered an unbelievable sum of money to heist a valuable jewel, you're drawn into something far more dangerous than you bargained for. *Thief: The Dark Project*'s richly detailed cityscape, complete with imposing mansions

and haunted cathedrals, draws you into the intrigue.

Tiger Woods 99 PGA Tour Golf (\$39.95 list; EA Sports, 800-245-4525, www.easports.com). You may not swing like Tiger Woods on the golf course, but you can certainly adopt his style on the PC. With superb graphics, this sim captures the many intricacies of golf, from mastering the putter to playing an uphill lie. Playing as Tiger or one of seven other PGA pros (including Mark O'Meara and Lee Janzen), you have the option of



nine play modes such as tournament and The Skins Game. Real-time moving cameras will capture your every triumph or mulligan.

Vigilance (\$39.99 list; SegaSoft; 888-734-2763, www.segasoft.com). Sort of like a modern-day A-Team, *Vigilance* puts you in the role of antiterrorist operative dispatched to stop a worldwide terrorist movement and find the mastermind behind the plan. You can choose from eight operatives, each with different strengths and weaknesses. You must then lead your character through 12 game locations, completing 20 detailed missions along the way. *Vigilance* can also be played as a

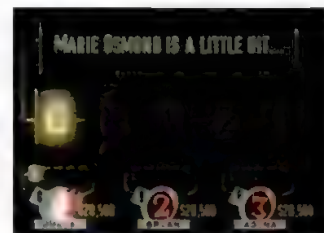


multiplayer game (in cooperative or death-match mode) or on Sega's Web site, Heat.net.

X Games Pro Boarder (\$39.95 list; ESPN Digital Games/Radical Entertainment, 415-229-9100,

[.radicalusa.com](http://www.radicalusa.com)). Sports authority ESPN joins the PC fray with the publication of this snowboarding game, which features the top professionals competing at the Winter X Games. After you've selected your board, you can hit the slopes as one of five of the sport's stars, such as Peter Line or Tina Basich. There are nine levels of play, including Halfpipe and Big Air, or you can just go freestyle and show off your stuff, performing some of the more than 2,000 trick combinations available.

You Don't Know Jack Volume 3 (\$30 street; Berkeley Systems Inc., 800-757-7707, www.berksys.com). By



now, just about everyone knows Jack, the grandfather of PC-trivia games, which is formatted in a television game show style. *You Don't Know Jack Volume 3* keeps the fun going with 800 all-new questions. There are also several new question types: In addition to the old favorites Gibberish and DisOrDat, there are now Three-Ways, Super Audio, and Impossible Question. The irreverence, caustic wit, and entertainment quotient remain as high as ever.

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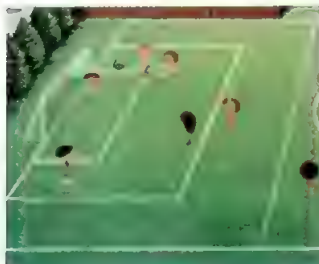
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KIDS' SOFTWARE

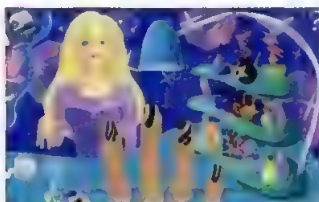
AGES 2 TO 10

Backyard Soccer (\$19.99 list; Humongous Entertainment Inc., 800-499-8386, www.humongous.com). Our kid testers went wild over this game, just as your kids will. This



soccer simulation features the 30 neighborhood kids made popular in Backyard Baseball, 20 different fields to choose from, and the option to play pickup games or tournament play. Kids can handpick the players on their teams, as well as choose team names, colors, and logos. The game play is exciting, but it's the attention to detail—from the players' bios to the quirky play-by-play narration—that makes this title a winner.

Barbie Nail Designer (\$20 street; Mattel Media, 888-628-8359, www.mattelmedia.com). Now girls can play "nail salon" at home without you having to worry about polish being spilled on your living room floor. Barbie Nail Designer lets girls create nail designs—with funky colors, bold patterns, or glitter and jewels—that they can then print out on the included nail-shaped stickers and wear. They get to select designs from three themes: Cool Styles, Daisy Days, and Glossy Glam. Kids will also love the disk's soundtrack, which they can play on an audio CD player.



Dr. Seuss Preschool, Dr. Seuss Kindergarten (each \$19.95 list; Broderbund Software Inc., 800-576-2610, www.broderbund.com).

Remember Horton, the loyal elephant? If the memory brings a smile to your face, you and your children will delight in these two educational titles from Broderbund. Horton, along with 50 other Dr. Seuss characters, leads your youngster through hundreds of lessons on such topics as rhyming and alphabet recognition.



Original songs and whimsical animations make learning fun, and multiple skill levels insure that your child won't quickly outgrow the material.

Fisher-Price Little People Christmas Activity Center (\$30 street; Knowledge Adventure Inc., 800-545-7677, www.education.com). What better way to usher in the Christmas season with your children than a CD-ROM loaded with holiday-oriented games and activities? Fisher-Price's Little People characters are the stars of this disk, which gives kids the chance



to build a snowman, decorate a tree, play reindeer games, and make their own holiday cards and gift tags. The disk also includes a Little People Christmas play set and sticker kit.

Happy and Max: The Pirate Treasure (\$18.95 list; Jamsa Press, 800-432-4112, www.happyandmax.com). Beginning readers will enjoy the tales

of Happy and Max, a spunky dalmatian and a little boy. And when they're done reading this hardcover book, they can pop in the accompanying CD-ROM and see the story come to life with animations, silly sound



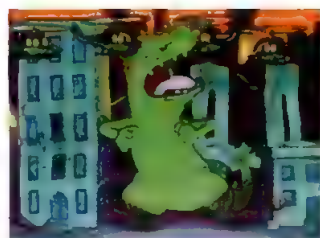
effects, and games. *The Pirate Treasure* is one of four books in the Happy and Max series, which finds the duo in a slew of misadventures.

Richard Scarry's The Best Christmas Ever (\$20 street; Simon & Schuster Interactive, 212-698-7000, www.ssinteractive.com).



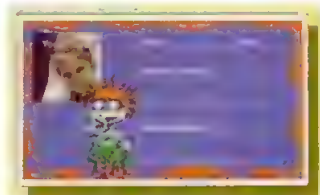
Based on Richard Scarry's beloved book series, *The Busy World of Richard Scarry*, Richard Scarry's *The Best Christmas Ever* features the familiar Busytown characters as they prepare to celebrate Christmas. There's an adventure game to tackle, and activities to partake in, such as decorating gingerbread cookies and Christmas trees. There's also a Christmas carol sing-along to get you in the spirit of things.

Rugrats Movie Activity Challenge (\$29.95 list; Broderbund Software Inc., 800-576-2610, www.broderbund.com). Unlike some of the other characters appearing in programs in our roundup, the Rugrats are not of our generation. But we bet your kids love them. Rugrats Movie Activity Challenge is based on the Rugrats motion picture and stars Tommy,



Angelica, Chuckie, and their buddies in six separate games. Each focuses on an area such as problem solving, critical thinking, or reasoning, and each is a blast to play.

Rugrats Print Shop (\$19.95 list; Broderbund Software Inc., 800-576-2610, www.broderbund.com). Kids can get creative with their favorite Rugrats character; they're all here in the Rugrats edition of Broderbund's Print Shop. The great thing about this package is that it includes more of the typical print-program projects (the birthday cards and calendars). Not only can kids incorporate Tommy or Chuckie into cards, but they can also make kids' stuff like growth charts,



diary pages, stickers, and birthday kits complete with wrapping paper and place mats. A note to parents: You're going to need a new ink cartridge after this one.

AGES 10 AND UP

Amazon Trail 3rd Edition: Rainforest Adventures (\$40 street; The Learning Company, 800-227-5609, www.learningco.com). As kids make their way through the uncharted lands of the Amazon rain forest, their lives will depend upon implementing what they've learned about botany, geography, habitats, and social science along the trail. If they navigate the rain forest successfully, the secrets of the ancient fortress of Vilcabamba will be theirs. Such is the premise behind Amazon Trail's

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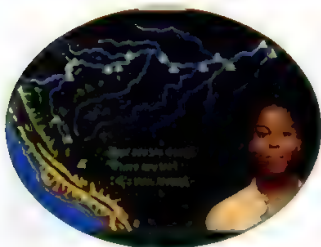
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AFTER HOURS



immersive, enlightening, and altogether entertaining trek through science and nature.

The American Girls Premiere 2nd Edition, Collector's Edition Tin (\$45 street; The Learning Company, 800-227-5609, www.learningco.com). History lessons unfold through the adventures of six characters, each of whom represents a period from Colonial America to World War II. Girls may already be familiar with these characters from the extremely popular American Girls Collection of dolls. Kids can use the



characters and their stories to develop and produce multimedia plays. In addition to the software, the collector's tin also includes a baseball cap and American Girls trading cards.

Barbie Jewelry Designer (\$34.99 list; Mattel Media, 888-628-8359, www.mattelmedia.com). Barbie and



"dress up" jewelry—could there be a better combination? Barbie Jewelry Designer lets children create necklaces, friendship bracelets, pins, and earrings with the dozens of color patterns and graphics included on the CD. The jewelry can be personalized by adding names or messages. Once kids have completed their designs, they can print the patterns

onto the included Print 'n Shrink paper and (with Mom's or Dad's help) bake it in the oven. Voilà: instant, wearable jewelry. Refill kits are available.

Dr. Brain Thinking Games: Puzzle Madness (\$30 street; Knowledge Adventure Inc., 800-545-7677, www.education.com). The year is 2326, and Dr. Brain's cloning experiment has gone terribly awry. Only your children can stop the evil clone running rampant on the streets and save the world. The mission requires that kids successfully complete seven mind-engaging puzzles (each with



three skill levels and dozens of scenarios) with names like Factory Fracas, Network Nuisance, and Power Towers. If they can score higher than their evil clone opponent, they'll move to the next level and get one step closer to defeating the clone and saving society. Are your kids up for the challenge?

Fashion Trip (\$40 street; Sierra Inc., 800-757-7707, www.sierra.com). Don't feel like driving your kids to the mall? Let them cruise the stores right on the PC. Fashion Trip is a virtual mall featuring clothes and accessories from 30 labels popular with teens, such as Diesel, Levi's, and Nicole Miller. Kids can wander store aisles, selecting items they want to try on in the virtual dressing room. There they can mix and match outfits and create new looks. Through the Internet, they can share the shopping experience with friends and get wardrobe updates.



HeadRush (\$30 street; Berkeley Systems Inc., 800-757-7707, www.berksys.com). Consider this game the younger sibling of You Don't Know Jack: The attitudinal, addictive trivia

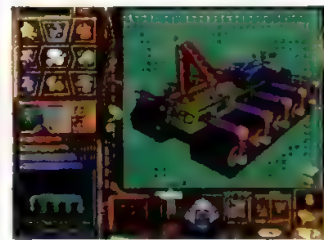


game has been adapted for the teenage set in HeadRush. Such topics as the television shows "Buffy the Vampire Slayer" and "South Park" and the punk band Green Day make up the 550 questions. Of course, the occasional intellectual eye-opener about Shakespeare or the Civil War is thrown in for good measure. Interspersed throughout the game show-style questions are cartoons and bizarre commercials from fake sponsors. The too-hip-for-words host and the cool music keep the pace moving fast enough to keep even a teen's attention.

Rocky & Bullwinkle's Know-It-All Quiz Game (\$27.25 list; Houghton Mifflin Interactive, 800-829-7962, www.hminet.com). Although Rocky & Bullwinkle's Know-It-All Quiz Game is marketed as a game for kids ages 9 to 12, we think adults will get a kick out of it too. Especially those adults with fond memories of the Rocky & Bullwinkle cartoons, of course. Bullwinkle J. Moose is your host for this trivia game, in which kids captain a team from Frostbite Falls, Pottsylvania, or Wossamotta U. The 2,800 questions (in 12 categories such as famous people, history, literature, music, and "moosecellaneous") can be adjusted to an appropriate difficulty level.

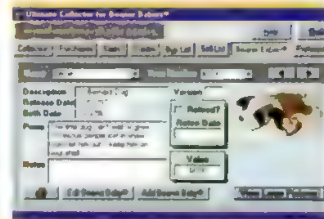


Star Wars DroidWorks (\$40 street; Lucas Learning, 415-444-8800, www.lucaslearning.com). With all the robot building and mission accomplishing your youngsters will be doing with Star Wars DroidWorks, they probably won't realize all the strategic thinking and scientific principles involved. It's programs like this that truly make learning fun. Kids can combine the 87 robotic parts to create millions of different droids, which can be viewed in a 3-D, 360-



degree design grid. As a member of the Rebel Alliance, your child's job is to build droids to complete a series of missions, each of which takes him or her one step closer to reprogramming the assassin droids of the Evil Empire.

Ultimate Collector for Beanie Babies (\$19.99 list; Palladium Interactive, 888-891-1919, www.palladium.net). Beanie babies are serious business for many kids (and adults), and this program provides a means of cataloging and organizing your collection. Not only can you input information such as the purchase dates of the Beanie Babies you own, you can use the database to look up



practically every iota of information about each of the little beanbag toys. From their values to the poem that accompanies each one, the database has the stats and keeps them current with downloads from the Beanie Baby Info Web site.

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GADGETS & HARDWARE

CalComp Creation Station (\$129 list; CalComp Inc., 800-458-5888, www.calcomp.com). One of the best all-in-one solutions we've seen, the CalComp Creation Station consists



of a small tablet, a wireless stylus, and a cordless mouse.

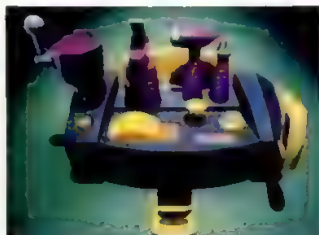
Neither the pen nor the mouse require batteries, and both use the QuickScroll feature for navigating documents or Web pages. The unit takes up no more room than a mouse pad, and provides a quick and easy way to incorporate graphics into your projects. It comes with Kai's Photo Soap and Art Dabbler.

Diamond Rio PMP 300 (\$199.95 list; Diamond Multimedia Systems Inc., 800-468-5846, www.diamondmm.com). At press time, the exact release date of the Diamond Rio PMP 300 was still in question. We included it nonetheless, because it's one of the coolest bits of electronics we've seen in recent memory. Rio, a portable music system resembling a palm-size Walkman, stores and plays up to 60 minutes of digital MP3-formatted music. It runs off one double-A battery, uses 32MB of on-board flash memory, and comes with software that lets you record your own music mixes with tracks from your CDs or the Internet.



Hasbro Tonka Workshop CD-ROM Playset (\$39.95 list; Hasbro Interactive, 800-683-5847, www.hasbro-interactive.com). In an interesting twist on computer toys, the Hasbro Tonka Workshop CD-ROM Playset has no processor and no IR transmitter. It

doesn't even have a battery. This cute little workbench fits snugly over any standard keyboard. After you've strapped it on and loaded up the



accompanying CD-ROM, kids can get to work. Sawing or hammering will trigger one of the keyboard's keys, which in turn drives the action on-screen—where Tonka Joe is leading kids in dozens of "fix-it" missions.

Intel Create & Share Camera Pack (USB version, \$149 list; PCI version, \$199 list; Intel Corp., 408-765-8080, www.intel.com). Version 2.0 of this easy-to-use digital video camera puts the focus on some nifty software.

While the camera—capable of capturing up to 30 frames per second—has remained basically the same, the software has a new user interface with easier access to the photo gallery that organizes your pictures. The package also includes "send to a friend" videophone software on CD-ROM that lets you have a video-conference, even with people who don't have PC cameras; they will still be able to see and hear you.



Kensington Orbit (\$60 street; Kensington Technology Group, 800-535-4242, www.kensington.com). Not only does the Kensington Orbit trackball look great, more important, it feels great. More closely resembling a



mouse than a conventional trackball, the Orbit will make believers out of those who thought they would never give up their mice. Its unique

shape—with its translucent blue ball—makes it equally accessible to right- and left-handed users. In addition to a trackball, the Orbit has two programmable buttons, which you can customize using the included MouseWorks software.

Kensington SmartSockets (various models, \$20–\$50 street; Kensington Technology Group, 800-535-4242, www.kensington.com). Just like the aunt who always gives you socks for the holidays, we've got a sensible gift idea too. The SmartSockets surge



protectors have six sockets and come in a standard

model or an adapter model, which holds up to six AC adapters. A recessed push-button on/off switch eliminates the chance of accidentally hitting the power switch. The color-coded sockets and tags let you match up your sockets to your devices—no more unplugging the wrong thing.

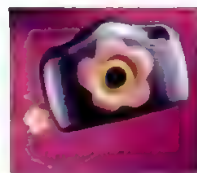
LEGO MindStorms Robotic Invention System (\$200 street; LEGO Group, 800-243-4870, www.legomindstorms.com). Even though this product is designed for children, we're sure more than a few parents will partake in some robot building. MindStorms is essentially the LEGO set we all remember, but this one has a built-in computer processor and an IR transmitter. You can build robots,



vehicles, and what have you with the set's 700 LEGO pieces, and then use the included software to program your creation to, say, follow a specified path or move objects. PC playtime has never been so much fun.

Mattel Barbie Photo Designer Digital Camera & CD-ROM (\$69.95 list; Mattel Media, 888-628-8359, www.mattelmedia.com). If Barbie is

all the rage at your house,



then the Mattel Barbie Photo Designer Digital Camera & CD-ROM is a must-have. It's a digital camera (in little-girl-friendly bright-pink and silver hues) and CD-ROM that work together to let your child insert herself into Barbie's world. After she's taken some photos (the camera's memory holds six shots), she can import them into the program and create, for example, a shot of herself driving Barbie's red Corvette. Templates for scrapbooks, stickers, and postcards are also included.

Mattel My Interactive Pooh (\$99 list; Mattel Media, 888-628-8359, www.mattelmedia.com). Following the same concept as Microsoft ActiMates Barney, My Interactive Pooh is a hardwired stuffed doll that can interact with both your child and the PC. Pooh's head and mouth



move as he sings 30 different songs, speaks your child's name (you program Pooh with the included software), or tells stories.

Microsoft SideWinder Freestyle Pro (\$75 street; Microsoft Corp., 800-426-9400, www.microsoft.com). The line of SideWinder gaming devices has always been among the best on the market, and the Microsoft SideWinder Freestyle Pro looks like another winner. It looks somewhat like a game pad, but incorporates a unique twist: motion sensitivity. While gaming, if you tilt the stick to the right or left your on-screen counterpart responds

accordingly. The Freestyle Pro ships with a great stunt racing game—Motorcross Madness.



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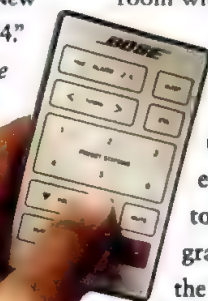
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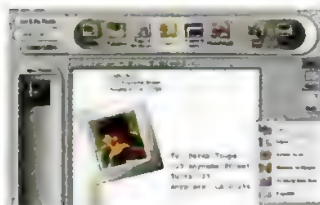
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Adobe PhotoDeluxe Home Edition (\$49.95 list; Adobe Systems Inc., 800-888-6293, www.adobe.com). Adobe PhotoDeluxe Home Edition offers



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of the hundreds of templates to create print projects, from calendars to certificates.

The Complete National Geographic: 109 Years of National Geographic Magazine on DVD (\$199 list; Mindscape Inc., 800-881-9919, www.mindscape.com). This four-disk DVD-ROM set contains all 190,000 pages—the articles, photos, advertisements, and maps—of *National Geographic* magazine, from its inception in 1888 through 1997. The 31-disk CD-ROM version was among our picks for the best CDs of the year, and the fact that it's been pared down to just 4 DVDs makes it that much more enjoyable. For those partial to CDs there is a collector's edition of The Complete National Geographic, packaged in a beautiful wooden box, available for \$200 street.



Hanes T-ShirtMaker (\$39.95 list; Austen-James, 800-426-3728, www.hanes2u.com). Making T-shirts with your kids is a great way to pass a rainy day—or a sunny one, for that



matter. Hanes T-ShirtMaker gives you everything you need to create "designer" originals that your kids will love to wear. You can use the more than 500 graphics the program provides, or import a favorite photo or drawing. The package comes with a T-shirt and two transfer sheets (20 additional sheets cost \$25).

MasterCook Deluxe (\$29.95 list; Sierra Inc., 800-757-7707, www.sierra.com). MasterCook Deluxe 5.0 combines a great recipe management tool with more than 5,500 recipes: The results are delicious. The program works with previous

Whisker-Popper Chops with Molasses Butter



- 4 bone-in pork chops, 1 1/4 inches thick
- 1/2 cup butter, softened
- 1 tablespoon molasses
- 1/2 teaspoon freshly ground black pepper
- 1/2 cup white rice
- 1/2 teaspoon salt
- 4 tablespoons coarsely ground or crushed

MasterCook releases, letting you incorporate those recipes into one central database. In addition, you can add an unlimited number of your own favorite recipes. The friendly interface makes it simple to navigate through the program, to modify or scale recipes, or to learn preparation techniques.

National Geographic Maps (\$80 street; Mindscape Inc., 800-881-9919, www.mindscape.com). For some readers, *National Geographic* magazine's maps are the best, hands down. This program features



every foldout map ever published by the magazine through 1997.



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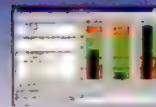
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Professor Franklin's Instant Photo Artist (\$39.95 list; Streetwise Software, 800-743-6765, www.swsoftware.com). Even if you can't draw a stick figure, you can paint a great-looking picture—one that's based on your own photographs—with Professor Franklin's Instant Photo Artist. The results are dazzling. You start by importing a photo into the program. Then you select a style, such as oil, charcoal, or Impressionist. The



program transforms your photo into a painting based on the selected style.

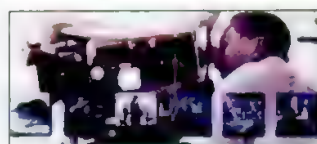
Star Wars: Behind the Magic (\$29.95 list; LucasArts Entertainment Co., 888-532-4263, www.lucasarts.com).

The gift for the Jedi Knight on your list, *Star Wars: Behind the Magic* takes you backstage for an in-depth exploration of the movie and the phenomenon. This two-CD set includes previously unseen footage, candid photos, and a look at the characters, vehicles, and actors that shaped the movies. There's also a scene-by-scene review of each of the first three *Star Wars* movies.



Walt Disney: An Intimate History of the Man and His Magic (\$39.99 list; Disney Interactive, 800-328-0368, www.disney.com). The creations of

Walt Disney have enchanted us for generations, but not much is known about the man himself. This disk



provides insight into Disney's creative genius through videos, photographs, letters, and the narration of his daughter Diane. Animations, drawings, and cel art are also featured in this wonderfully in-depth retrospective of a man and his work.

WebStudio (\$49.95 list; Sierra Inc., 800-757-7707, www.sierra.com). If you can use your mouse to drag and drop objects, you can use WebStudio to create Web pages—impressive pages, at that. What makes this program work is its combination of an affordable price, an efficient interface, and a jam-packed catalog

of graphics, backgrounds, and templates. You can also import your own graphics files or create your own templates using the step-by-step wizards.

Zondervan New International Version Bible (\$49.95 list; Mindscape Inc., 800-881-9919, www.mindscape.com). Although there is a Santa Claus at every corner and evidence of commercialism everywhere at the holidays, many people choose to focus on the religious significance of the time. Zondervan New International Version Bible provides both the King James and New International Version translations. Readings by James Earl Jones and inspirational music enhance the entire experience. **PC**



Coming Up

What's in the Next Issue of *PC Magazine*

The Best Products of 1998

Once again, the editors, Labs staff, and contributing editors are putting together our list of the best products we saw in 1998. Remember, these aren't necessarily the most technically excellent (that list is in the issue you're holding), but they're the ones we find it easiest to recommend to readers.

Web Storefront Software

Ready to set up the next generation of your store on the Web? We'll deliver reviews of the hottest packages for getting set up and running well. How easy are these packages to use, really? Do you need to code? What about database connections and transactions? We'll have it all.

Replacement PBXs

For decades, private branch exchange (PBX) telephone systems used in offices and corporations of all sizes have been high-priced and proprietary. That changed overnight. PC-based PBX systems can beat the proprietary hardware in function and price. We'll report on several different PC-based PBX systems for carrying your telephone traffic while also improving productivity and reducing management overhead.



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Hugh Bennett, *E*Media Professional, December 1998

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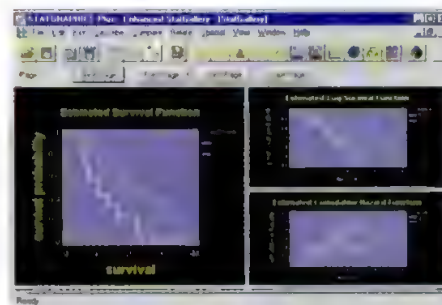
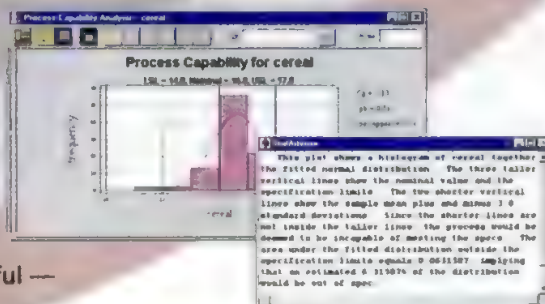
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Built To Perform—For You! The AMD-K6-2 3DNow!™ starts with Tiger's incredible Super Socket 7 motherboard. It's loaded with features like AGP video port—it transfers data at an astonishing 528MB/second, that's 10 times faster than PCI, Ultra DMA/33 controller onboard, and the motherboard bus speed runs up to 100MHz—it has a 35% boost in performance over 66MHz bus systems. A faster bus speed makes your memory, expansion slots, CPU and more go faster. But, as we mentioned earlier, the biggest difference is in the AGP slot, the new bus speeds push AGP's 528MB/sec. x2 mode to its limits. Only the

AMD-K6-2 combines advanced six-issue RISC86 instruction decoders, large on-chip L1 cache, 3DNow!™ technology and AGP graphics for sixth generation performance!

Astounding 3D Capabilities! The AMD-K6-2 3DNow!™ processor delivers a superb 3D multimedia experience—you'll love it! Utilizing AMD's instruction set, Microsoft DirectX 6, OpenGL API libraries, and leading game development tools, it provides sizzling gaming action. The K6-2 processor will accelerate and enhance 3D graphics with full-featured MPEG-2 video and AC-3 (Dolby Digital™) sound.

It's A Great PC Value! The AMD-K6 is a low-cost, high performance CPU, but there's more to a complete multimedia system than just the processor. That's why AMD built the K6 to fit on a motherboard with a standard Socket 7 processor base... the same type of motherboard used for the Pentium MMX and IBM 6x86MX processor. In other words, these motherboards are built in high volume with competitively lower prices and more popular

The All-New AMD-K6-2 With 3DNow! Technology

The AMD-K6-2 incorporates a design technology which has been developed specifically for today's demanding multimedia, graphics, video and game software. You'll experience dazzling images, silky-smooth video and awesome gaming! Tiger built on this advanced processor technology, adding quality components and craftsmanship to create a powerful computing value! Try the AMD-K6-2!



features. The Intel Pentium II, on the other hand, use their own unique processor socket. So there are fewer built with inherently higher prices. And with competition you get technical

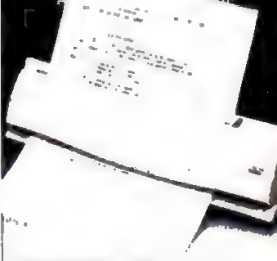
advances born out of necessity—like Tiger's high-performance DIMM memory slots. DIMM slots have twice the throughput (64 bits) of SIMMs, giving an overall performance boost. You also get the new VIA MVP 3 chipset—one of the fastest available today.

Great Systems Begin With Quality Motherboards!

While the AMD-K6 MMX processor is pulsating with ready-to-run power, the motherboards that we've selected for these state-of-the-art systems add their own dimension of advanced technology. Tiger's technically superior motherboards feature both DIMM and SIMM memory slots, so you can run whatever type of memory suits your needs—from error-correcting ECC RAM, to SDRAM. These motherboards also support Ultra DMA/33 hard drives—bursting hard disk transfers up to 33MB/sec! New Ultra DMA/33 mode is twice

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as fast as the previous best. You also get wave table sound and support of Microsoft's PC'97 specs. The AMD-K6-300 MHz with MMX technology comes with Tiger's marvelous AT motherboard with 512KB of

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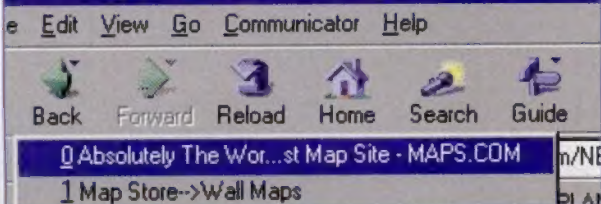
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Zip-a-Dee-Duh!

Faithful reader Douglas Morse got this cry-for-help message from a colleague: "I bought a Zip disk thinking I would simply copy my entire hard disk onto it. Trouble is, it's not built to fit the floppy disk drive. Do you know anything about this? The box tells me it's formatted for IBM-compatible computers, but it sure is a funny shape."

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Weather



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What the insiders are
probably thinking
is that they should
get outside as soon
as possible.
(MSNBC.)

Follow the Bouncing Press Release

Yes, there's a Web site for everything. Here's proof: "Located at www.justballs.com, the world's first and only Internet-based retail ball store will offer consumers access to an unparalleled array of sports balls, toy balls, exercise balls, promotional balls, and related equipment."

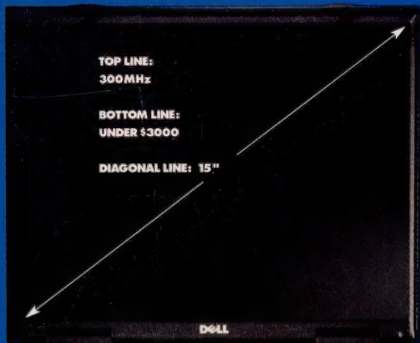
Oops! Netscape Navigator
does some unfortunate abbreviating.



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